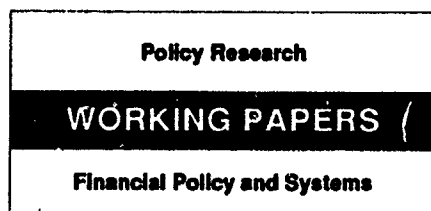


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Regulatory and Institutional Impacts of Securities Market Computerization

Robert Pardy

**A guide to regulatory best practice in the computerization of
securities markets.**

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This paper — a product of the Financial Policy and Systems Division, Country Economics Department — is part of a larger effort in the department to explore ways to promote the development of sound securities markets. Copies are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Zena Seguis, room N9-005, extension 37665. (February 1992, 69 pages.)

Advances in information technology have brought new ways of structuring, operating, and supervising securities markets. The Bank's policy advice in institutional reform of securities markets should reflect awareness of the opportunities and problems this presents.

As a guide to best practice, Pardy provides basic operational and policy tools that take account of the importance of information technology in two securities market functions — trading and clearance and settlement.

Pardy suggests that information technology systems — even though they may not differ greatly from manual systems in their performance of securities market functions — pose new technical problems for market supervisors and can affect the rights and obligations of market participants.

He provides policy principles that take these factors into account, to guide the planning, evaluation, and supervision of trading and clearance and settlement systems that include an information technology component.

Pardy explains how the processes and functions of a securities market can be performed in a variety of ways, including hybrid and tandem systems, using both manual and information technology approaches. Information technology, especially in hybrid and tandem systems, has already spread far in emerging markets and its spread is likely to accelerate in the 1990s.

He gives examples from emerging markets (some of which have world-class systems) and from developed markets (in some of which the systems are not as advanced).

Highly sophisticated information technology systems are not always necessary or desirable, but the well-planned use of information technology can improve a security market's efficiency, fairness, and stability. Clarity of objectives, good planning, and a clear grasp of operational implications are important in effectively evaluating proposals for developing securities markets with an information technology component.

The Policy Research Working Paper Series disseminates the findings of work under way in the Bank. An objective of the series is to get these findings out quickly, even if presentations are less than fully polished. The findings, interpretations, and conclusions in these papers do not necessarily represent official Bank policy.

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Glossary of Acronyms

ACES	Advanced Computerized Order Execution System (NASD)
ADR	American Depositary Receipt
CATS	Computer Assisted Trading System (Toronto Stock Exchange)
CDS	Canadian Depository for Securities
CNS	Continuous Net Settlement
CORS	Computerized Order Routing System (Korea Stock Exchange)
CSD	Central Securities Depository
DVP	Delivery Versus Payment
G30	Group of Thirty
Instinet	Proprietary trading system marketed by Reuters Plc.
INDEVAL	Instituto Para El Deposito de Valores (Mexico)
KSCC	Korea Securities Computer Corporation
KSE	Korea Stock Exchange
KSSC	Korea Securities Settlement Corporation
NASD	National Association of Securities Dealers (USA)
NASDAQ	" " " " " Automated Quotation System
OMS	Order Management System (Toronto Stock Exchange)
OTC	Over The Counter Market
SAEF	SEAQ Automated Execution Facility (London Stock Exchange)
SEAQ	Stock Exchange Automated Quotation System (London Stock Exchange)
SIAC	Securities Industry Automation Corporation (USA)
SMATS	Stock Exchange Automated Trading System (Korea Stock Exchange)
SMIS	Securities Market Information Service (Korea)
SOES	Small Order Execution System (NASD)
TSE	Toronto Stock Exchange

I INTRODUCTION

World Bank policy advice on institutional and regulatory reform of securities markets generally has the goal of improving their efficiency, fairness and stability. The Bank's advice should take account of information technology's relevance to these goals because IT has had a considerable impact on the way securities markets are structured and operated. In the two operational areas of trading, and clearance and settlement, this means assessing the traditional ways of operating and the new ways made possible by IT against a set of principles derived from the goals of efficiency, fairness and stability.

Securities market trading has traditionally been conducted by traders gathering at a central point to quote buy and sell prices and to strike a deal when prices matched. Early forums for such gatherings were coffee houses and curb-sides but these gradually gave way to the trading posts of stock exchange floors around which traders gathered to trade the stocks listed on each post. Stock exchanges began as associations of such traders who wished to gather together to trade because of shared interests and mutual trust. Over time, the exchanges came to provide a range of related services to their members such as clearance and settlement of transactions executed on the floor.¹

In the post World War II period, many aspects of this system have been changed by the introduction of information technology. Building on the foundations of traditional manual systems, the use of IT has come to be a central feature of securities market operations, and has been a significant influence on both the structure and behavior of the markets. In the last decade in particular, the introduction of IT has had a profound impact, not only in the large, well established markets, but also in emerging market countries.²

An important change has been on the floor of the exchange. By providing the means for capturing and displaying large numbers of bids and offers for securities over a distributed network of

¹ Annex I provides an overview of the total securities market process and describes each of its fourteen constituent functions. Readers unfamiliar with securities markets may find it a useful introduction to the subject and its terminology.

² For an overview see Siegel, "The Competitive World of Electronic Trading"; Glaser, "The Intersection of Technology and Financial Services"; Saunders and White, Technology and the Regulation of Financial Markets; and Phillips, "The Increasing Impact of Computer Technology".

terminals, IT has fundamentally altered the way securities trading is done. Intermediaries such as stock brokers have seen their monopoly over trading and trade information weakened as large investors and other participants gained access to real-time market information through computer networks. A high volume of trading is now done away from traditional stock exchange trading floors. This move away from central trading floors has forced market supervisors to consider difficult trade-offs between the efficiency benefits deriving from a larger number of diverse securities market service-providers and such problems as market segmentation which may diminish the market's price setting efficiency.³

Like securities trading, clearing and settlement of transactions has changed radically in the last ten years. The physical movement of share certificates, transfer instructions and payments has been replaced in many places by "book entry" systems which rely on computer records of entitlement to securities and the automatic debiting and crediting of payment accounts. As a result, clearance and settlement can be concluded in a shorter period with consequent risk reduction and efficiency gains. On the other hand, such systems have required expanded secure custody arrangements, very accurate record keeping and changes to legal definitions of evidence of title. Market supervisors have had to develop rules and monitoring programs which attempt to protect investors' rights under the new systems.

More generally, the spread of IT in securities markets has often made the markets so dependent on automation that a systems failure is tantamount to a market failure. As a result, regulators have greater responsibility to oversee the safety and soundness of technical IT systems whose failure could have market-wide consequences. This calls for back-up and disaster recovery systems by market providers, but also improved technical capacity of the regulator to enable adequate supervision.⁴

Emerging securities markets as well as the world's traditional financial centers are confronting these issues. Perhaps the starkest emerging market examples are found in Eastern Europe where sweeping reforms in the financial sector have often included the speedy establishment of a securities market infrastructure from little or no base. In some Eastern European countries the newest IT systems have been brought into operation at the very beginning of experience with the basics of market operation and supervision. Less dramatic developments are in evidence in many other emerging markets. For example, Turkey is at the first stage of a sequenced IT enhancement program from a low base, while

³ Lucas and Schwartz, The Challenge of Information Technology for the Securities Markets, p. 4, call these "second order effects" of IT in securities markets.

⁴ The US SEC releases 27445 and 29185 of November 16, 1989 and May 9, 1991 provide a good introduction to these issues.

Malaysia and Mexico are extending already sophisticated IT systems, and in the Philippines, the supervisory authority has identified the expanded use of IT in the stock exchanges and stock brokers' offices as a key tool in detecting and reducing market manipulation, insider trading and other breaches of the law.

Increasing automation of securities market functions is a trend which will increase in the 1990s, perhaps particularly in emerging markets. This is likely because competition between software and hardware providers will continue to bring costs down and because the increasingly international nature of securities market trading will encourage a convergence of standards of efficiency, fairness and stability towards those offered in highly computerized markets. An example of the first is the Reuters Instinet system which is less expensive now than it was five years ago and yet offers enhanced services. An example of the second is the internationally agreed standards for efficient clearance and settlement proposed by the Group of Thirty which imply the use of computerization.⁵

On the other hand, it should not be assumed that a high level of computerization is necessary or desirable in all situations. For example, in small but growing securities markets, upgrading manual systems and gradually increasing the use of computer support is a viable approach. Deciding on the appropriate pace and sequence for modernization requires a balanced consideration of four factors: the scope and scale of changes needed to accommodate the volume of transactions conducted on the market; the capacity of the local infrastructure, institutions and personnel to assimilate the changes; supervisory imperatives such as the need for effective market monitoring, enforcement of trading rules, and investigation of unlawful transactions; and the capital and recurrent costs of the modernization program in relation to the size of the market and the way the costs will be met. No single factor dominates and no simple formula applies in all situations, so striking the right balance between the four factors is a matter of country-specific analysis. It follows that no single prescription will arise from the analysis. The range of outcomes will cover the spectrum from improved manual record keeping and paper handling, through small-scale computer assistance for these functions, to sophisticated fully-computerized trading and clearance systems.

Nor should it be assumed that IT is the solution to securities market development in emerging market countries. In fact, IT is but one element of the institutional arrangements making up a securities market. Development of the market is facilitated by improving such institutional arrangements but derives its impetus from other factors. Chief among these is the creation of a conducive

⁵ The G30 proposals are discussed in detail in section IV.

business and investment environment and removal of impediments or distortions to capital-raising and investment decisions in such areas as tax and interest rate policies. When the macro-economic and fiscal pre-conditions are right, a sufficient supply of quality securities and investment-seeking savings will be available to create a viable securities market. Institutional impediments to development of the market which then arise will become important areas for reform in order to allow the market to meet the needs of capital raisers and investors. This paper argues that it is likely that such reforms will include the increased use of IT and that the role of IT deserves careful attention but it does not assume that institutional change can itself generate the impetus for market development.

In the World Bank, SAL, FSAL and TA programs which include institution building in securities markets are becoming more common. It follows that Bank staff and country policy makers will increasingly be called on to evaluate the use of IT to enhance or detract from securities market development. The present paper is an attempt to assist that evaluation by providing basic operational and policy tools as a guide to best practice.

The paper has three substantive sections. First, the basic reasons for the move from manual to computer assisted processes in securities markets are described and the key players and their motivations in the drive for automation are identified. Examples from emerging and developed markets are used to illustrate the points made. This is followed by a section which describes the securities trading process and the potential benefits and risks associated with performing each of the trading functions via IT systems. Several operational examples are given to demonstrate the variety of approaches taken to organizing trading in a manual, computerized or hybrid form. Then follows the core of the section, which provides nine principles to guide decision-making on the use of IT in trading systems. The next section deals in a similar way with clearance and settlement. And finally, several annexes are provided which describe each of the functions which make up the total securities market process and give details of systems in operation in both developed and emerging markets which are bench-marks of excellence. Readers unfamiliar with securities markets may find it useful before they begin the substantive sections to consult Annex I for an overview of the securities market process.

Box 1 Example Of A Computerized Securities Market System

The CATS (Computer Assisted Trading System) of the Toronto Stock Exchange was the first automated market system introduced by a stock exchange. It has been used as a model in a number of developed and developing country markets: Korea, Malaysia and Taiwan followed CATS principles in developing their local systems; Tokyo, Sao Paulo, Paris, Lyon, Brussels and Madrid bought CATS from the Toronto Exchange; and exchanges in Venezuela, Portugal and the Philippines are considering installing CATS in the near future.

Price quotation and trading characteristics. CATS is an order driven continuous auction market. The CATS screen shows the size of orders and the prices for each security and the identity of the intermediary who has entered the buy and sell orders in question.

Automated order execution. Each buy order which is matched by a corresponding sell order in amount and price is automatically executed. Once orders are executed, printed trade confirmations are immediately sent to both the buying and selling brokers and a record is kept for the clearing system.

Clearing and settlement. The clearing and settlement process in Canada is centralized for the country as a whole and hence is separated from the stock exchanges. Stock exchange member firms use the custodial and clearing facilities of the Canadian Depository for Securities Limited (CDS). CATS provides an Order Management System (OMS) which links CATS, brokers' back-offices and CDS on an automated real time network.

Market surveillance. The CATS market surveillance system contains pre-set surveillance parameters for price and volume for every security. Any trading activity exceeding these limits is immediately signalled to the market supervisor so that an investigation can be initiated. Computer-generated trading reports are available for daily, weekly and monthly analyses so that possible insider trading, market manipulation and other questionable trading practices can be identified at an early stage.

Market information. The CATS software includes an extensive information system which is essentially a data base obtained from real time computer to computer links to other systems. It can provide interrogatable real time data to many terminals and can be operated by the market provider or sold to a specialist information vendor. It can provide all the basic data generated by trading plus calculate various accumulations and indexes by sector, instrument or other grouping.

A more detailed description of the CATS system is given in Annex IV.

II INITIATION AND SEQUENCING

Manual methods of trading securities were satisfactory for many years; why has IT become such an influence recently? One answer is that the availability of lower cost, fast and accurate IT systems is a development which grew alongside the growth in secondary securities markets. But why did the markets take to IT so readily?

The answer is to be found in the fact that a central function of securities markets is the handling of information. As the volume of that information grew and the demand for greater access to it also grew, it was natural that IT would be brought in to supplement manual processes. The price-setting mechanism at the very core of secondary securities trading requires the exposure of current bids and offers and information about recent transaction prices. Supplementary information about the enterprises which underlie the securities being traded is also important in a decision to buy or sell. Post-trade transaction processing and market monitoring are also built around the collection, assimilation and dissemination of information.

The driving force for the increased use of IT in securities markets is consequently diverse and variously motivated. First, it may be introduced to respond to the demands of intermediaries and their clients for more efficient execution of transactions and for access to more sophisticated trading strategies. In emerging markets this demand is strongest when the financial sector have reached a degree of development which makes such improvements important for further progress; for example, when the volume of securities trading has grown to overwhelm existing systems or where development of viable contractual savings institutions requires that they have access to timely and accurate trading data to allow them to use modern portfolio management techniques.

Second, market providers such as stock exchanges may seek to improve market infrastructure by introducing IT to provide added value or to reduce transaction costs and enhance their position in the financial services market. Existing stock exchanges in many places have been spurred to such initiatives by competition from independent information providers such as Reuters Plc. which have developed a range of securities market systems which are a direct challenge to many of the roles traditionally performed by stock exchanges.⁶

⁶ Twenty such proprietary electronic trading systems are registered with the US SEC, twelve of which are presently active.

And third, securities market supervisors may require improvements in trading, clearance, settlement and market reporting systems in order to provide for greater efficiency, fairness, transparency, and systems stability and to provide a better platform for their own monitoring and investigation activities.

In emerging market countries such as Korea, Thailand, Turkey and Poland, where the governments have a clear policy for institutional development of the securities market, the supervisory authority has taken the first step in the automation process and brought stock brokers and stock exchanges in as partners. In Taiwan, and to a lesser degree Hungary and Mexico, the stock exchanges have played a more active role in seeking to use computerized systems to improve the services offered and to reduce costs, with the supervisory authority supporting the stock exchange initiatives. The balance of recent history appears to favor government involvement at the early stages of development but a general conclusion on the optimal extent of that involvement would be unwarranted on the present evidence. Comparing Korea, Mexico and Taiwan, for example, which have had differing degrees of government involvement, there does not appear to be evidence of one approach being overwhelmingly more successful than another: each has successfully modernized their systems, making good use of IT, to facilitate rapid market growth. Korea used an IT systems development plan as a key part of a concentrated securities market institution building program; Taiwan's stock exchange systems were overwhelmed several times by growth in the volume of trading and improved systems were devised in response; and in Mexico there has been a mix of these two, with the government actively involved in the planning and funding of the stock exchange's modernization but not directing it.

Some emerging markets which are at an early stage of development, such as Czechoslovakia and Poland, have taken the opportunity to move quickly to integrated state-of-the-art systems. This contrasts with Korea, Malaysia or Mexico which have developed a strategy for sequenced implementation of their systems. The advantage of the first approach is that the new infrastructure is capable of supporting market growth without the bottlenecks and problems of having trading volume outstrip system capacity. The disadvantage is that it adds a non-market element to what is essentially a business decision. This is because it involves "over resourcing" ahead of actual demand for the services provided. Such over resourcing is hard to justify on rate-of-return grounds unless a very rapid growth in volume to high levels is expected. It is better considered an infrastructure expenditure with expected longer-term developmental benefits which government may wish to sponsor.

Cost and system capacity are factors in this decision. A fully automated trade execution system with ancillary functions costs from US\$4 to 8 million depending on the configuration. The CATS

system is in this price range and has a capacity of 40,000 transactions per day. It is installed in Paris to handle 11,000 per day and in Brussels and Sao Paulo to handle 5,000 per day. In contrast, an equivalent sized price quotation and trade reporting system costs one third to one half the price of the fully automated trading system and still brings considerable efficiency and fairness gains. A well planned gradual introduction of IT support to these functions can lead to eventual full automation as market capacity grows.

Box 2 IT Introduction in an Emerging Market - Korea

Korea is illustrative of a strong government role in an emerging market. In the eighteen months to early 1977 the government of Korea proposed and discussed fundamental reform of the securities market. A close consultative relationship was established with the private sector and a joint plan was developed.

IT was included in the planning process from the start: in January 1977 the Government published a detailed IT master plan; and in September 1977 it established one of the cornerstones of the IT plan--the Korean Securities Computer Corporation ("KSCC")--to develop, own and manage IT facilities. Like the stock exchange itself, KSCC was initially Government owned but was sold to the private sector in 1986.

The first function computerized was a market information system which began operation in July 1978. This was followed by an order routing and broker back-office system, then development of the Korea Securities Settlement Corporation ("KSSC") in 1983 which was upgraded in 1984. KSSC is a fully automated central depository and clearance and settlement institution fully owned by the Stock Exchange. Finally, in 1988 trade execution was automated, gradually building until by January 1990, 90% of securities trades occurred on the automated system.

In summary, the process of computerization was government initiated, centrally planned and incremental. It was also part of a strong institution building effort by the government in the finance markets in general.

More detail on the use of IT in the Korean securities market is given in Annex II.

Securities markets in developed countries, where IT has had a longer history, have tended to gradually automate functions as the need to do so arose, either from market or regulatory pressures, and as commercial funding of the developments became practicable. The approach taken has varied from country to country but perhaps a general pattern can be identified in which flow-of-trades and market data systems are developed first, then clearance and settlement systems, and lastly trade-related and market monitoring systems. This is the pattern of developments in the UK and USA for example.

In part, the pattern of evolution in each place is determined by the prevailing legal and institutional structure, and commercial custom and practice. A well established stock exchange and stock broking industry may resist changes which will diminish their profit making ability and power. The UK and USA provide two examples of such resistance. Such conflicts are perhaps inevitable when rights and obligations are altered. This is dealt with more fully in subsequent sections.

Box 3 IT Introduction in Developed Markets - UK and USA

The London Stock Exchange introduced a distributed quote display in broker's offices in 1969; an inter-broker net settlement system in 1979; computer assisted trading in 1986; and automated trade execution for small orders in 1988. The initial motivation for the enhancements came from the supervisory authority, but the Exchange itself soon took up the initiative. But opposition to fully automatic execution of trades continues and the great majority of trading is conducted by manual execution. Similarly a proposal to centralize and automate transfer and registration of securities has also been subject to much debate and delay over the last six years.

In the USA transfer and registration has been centralized in four depositories which immobilize the securities and maintain automated account records. This is much more advanced than in the UK. There are several trading systems: e.g., trading on the distributed computer network of the National Association of Securities Dealers (NASD) is computer assisted, although only small orders are executed automatically by the system; on the New York Stock Exchange the principal trading sessions each day are floor based computer assisted trading with small order automatic execution and after hours computer network trading.

Because there are many exchanges, the US Securities and Exchange Commission (SEC) proposed a national market system to ensure that clients obtain the best prevailing price for an order. The initial SEC proposal was for a broker to market universal message switch that would automatically route orders to whichever market offered the best price. That proposal was abandoned after strong opposition from stock exchanges. The stock exchanges proposed a compromise which provides a market to market link via the Inter-market Trading System (ITS) and this was accepted by the SEC.

Annex III describes in more detail the principal features of IT on the London Exchange in the UK and the National Association of Securities Dealers Automated Quotation (NASDAQ) market in the USA.

III SECURITIES TRADING

Constituent Functions

Three functions are commonly thought of as constituting the securities trading process: display and comparison of buy and sell quotes; order matching; and order execution. These functions may be performed in more or less automated ways, together or separately, and according to a variety of rules, methods and conventions.⁷

Quotes are displayed and compared as a key step in the price setting process - the bringing together of all the expressed buy and sell intentions of traders to be matched or to be bid up or down in response to the views other traders take to the changing value of the securities. The traditional quote display mechanism is a chalk board at a trading post on a stock exchange floor but, these days, is more often computer screens, either centralized on the exchange floor or distributed in broker's offices.

Matching occurs when the quoted buy and sell prices for a security coincide so that a deal may be struck. On a trading floor, matching is achieved by the traders calling out their bids and offers in response to the displayed quotes, and in that way identifying themselves to the other party to a trade, and indicating the terms on which they are willing to trade. Computer trading systems have a range of matching mechanisms which are designed to achieve a broadly similar result by using a set of programmed matching rules.

Trade execution is accomplished on a stock exchange floor by two dealers identifying each other and agreeing to strike a deal which they then record for later processing. Computer systems may allow dealers to follow a similar pattern of selecting their counterparties or they may automatically execute trades once they are matched according to pre-set rules of the system. In some computer systems the executed trade is "locked in" and requires no further clearance before settlement takes place. In others, the trade requires the same post-trade processing as is common with manual systems.

⁷ A more complete description of the total securities market process and its fourteen constituent functions is provided in Annex I.

Operational Categories

There are two basic types of trading system—order driven and quote driven; three methods of determining price—continuous auction, call (or single) auction, and non-auction (or dealer market); and two possible physical arrangements—centralized or distributed (see Box 4).

While the different categories have historically been regarded as separate and, to some degree in competition, the trend now is towards integrated and hybrid systems. This trend means that market supervisors often have to consider IT policy questions concerning partial computerization and the interaction between different parallel and linked systems. The matrix in Figure 1 illustrates the permutations possible from combining the various operational categories. Many of the combinations indicated are in operation now. For example: the Korea Stock Exchange, like most continuous auction markets, opens with a call auction to clear the pre-session order build up; the NASDAQ system is an evolution from the traditional dealer market into a form of auction market because of the competition between market makers built into the NASDAQ system; and the New York Exchange switches to distributed network computer trading after the close of each day's floor trading session.

Box 4 Operational Categories

The quotes which drive the trading process may be the bid and offer prices specified in investors' orders or they may be the spread quoted by market makers. The first is called an order driven market, the second, a quote driven market.

Each may be conducted as either a continuous auction in which quotes are constantly adjusted in line with new orders coming to market, or a call auction in which the quotes collected in a trading period are executed all at once at a price calculated to clear the maximum number of orders. Another alternative is a quote driven non-auction (or dealer market) in which one market maker has exclusive right to quote a buy and sell spread for a stock and sets the quote without competition.

The physical arrangement of the market may be centralized, on a trading floor for example, or it may be distributed via a network of computer terminals. In either case, the objective is to bring together the buy and sell quotes by some means which will allow them to interplay as a price setting mechanism.

Figure 1 - Matrix of Trading Characteristics

	O r d e r D r i v e n	Q u o t e D r i v e n	C e n t r a l i z e d	D i s t r i b u t e d	C o n t i n u o u s A u c t i o n	C a l l A u c t i o n	N o n - A u c t i o n
Order Driven	X		X	X	X	X	
Quote Driven		X	X	X	X	X	X
Centralized ¹	X	X	X	X ⁵	X	X	X
Distributed ²	X	X	X ⁴	X	X	X	X
Continuous Auction	X	X ³	X	X	X	X ⁷	
Call Auction	X	X	X	X	X ⁶	X	
Non-Auction		X	X	X			X

- 1 Often called "Floor based" in reference to the traditional stock exchange trading floor but may also be a trading room such as in Warsaw or Tokyo.
- 2 Commonly a telecommunications and computer network linking broker/dealer offices.
- 3 Requires competing market makers who continuously respond to the quotes and sales occurring across the market.
- 4 After close of centralized trading session.
- 5 As above.
- 6 At opening of continuous auction session to clear pre-session quotes.
- 7 As above.

Policy Considerations

The underlying objective of securities market supervisors is to ensure that trading takes place in an efficient, fair and stable manner.⁸ The increased use of IT in securities markets has not changed these goals, and at base has not changed the questions that must be asked and the issues which must be pursued. On the other hand, securities market supervisors, perhaps especially in emerging markets, find themselves having to deal with unfamiliar concepts and terminology in dealing with IT systems and the hybrid or tandem operations which are sometimes created.

World Bank staff and local policy makers seeking to orient their planning and evaluation in these circumstances may find it useful to refer to the best practice principles described below. Their purpose is to guide analysis and questioning of IT proposals. Of course they do not provide set answers applicable in all cases -- the answers will be as diverse as the situations in which the policy makers find themselves.⁹

Principle 1. The system should meet and continue to meet all applicable legal standards, regulatory policies, and market customs and practices.

Although screen-based trading systems may follow similar trading methods as manual systems, they may be different in their impact on the rights and obligations of market participants. For example legal and operational issues may arise from changes in contractual obligations between intermediaries, investors, system sponsors and system providers¹⁰, and from changes in custom and practice which may include loss of the ability of brokers to choose

⁸ There is in practice some conflict between these three goals. For example, one view argued loudly on the London Exchange is that the regulator's idea of fair trading requires disclosure of more information on bids and offers than would be efficient: market makers do not want to disclose their limit order books because it would allow competitors to read the market and position themselves to the disadvantage of the market makers.

⁹ The principles presented here owe much to the report of the International Organization of Securities Commissions Technical Committee Working Group on "Regulation of Derivative Markets, Products and Financial Intermediaries".

¹⁰ The system sponsor is the (authorized) market provider and host for the system -- typically a stock exchange. The system may be developed and operated by a separate entity -- the system provider. This may be an information systems specialist such as Reuters Plc.

counterparties, or to settle transactions at any time mutually agreed. In proposing computerization, system sponsors and system providers should satisfy the regulatory authority that the system meets all applicable standards even though the rights and obligations of participants may be different from those which prevailed under manual trading.

Also, because technological innovation in the IT field is rapid and tends to lead, not follow, legal innovation, the regulatory authority should seek to ensure that existing standards, rules, and policies are sufficiently flexible to allow technological innovation while at the same time not losing sight of the basic goals of fairness, efficiency, and market stability.

Principle 2. The system should be designed to ensure the equitable availability of accurate and timely trade and quotation information to all system participants and the system sponsor should be required to gain the approval of the regulatory authority for the rules and procedures for processing, prioritization, and display of quotations and reporting of trades within the system.

"System Transparency" refers to the extent to which relevant information is available in a trading system about open or unexecuted orders and completed transactions. Regulatory objectives are to ensure: (i) sufficient transparency to allow efficient trading and engender investor confidence in the fairness of the market; and (ii) avoidance of inequitable discrimination among like classes of market participants with regard to the availability of market information.

Determining what sufficient transparency is a matter of balance and judgement. Box 5 gives examples of the types of information commonly required to be provided. The regulatory authority should decide and agree with the system sponsor or provider what information is to be available on the system and under what circumstances. These details should be reflected in the specifications for the system which are agreed by the regulatory authority. The regulatory authority should also be satisfied that the system is technologically capable of disclosing the information which it is designed to make available and, conversely, that there are safeguards to preserve the confidentiality of other information, the disclosure of which is not intended.

Box 5 Examples of Information Commonly Provided:

Price of the most recent transaction,
Quantity of the most recent transaction,
Time of the most recent transaction,
Parties to the most recent transaction,
Current best bid and ask prices,
Quantity at those prices,
Parties who placed those orders,
Prices of bids and asks behind the best prices,
Quantity at those prices,
Parties who placed those orders,
Requests for quotes in the system,
Parties who placed those requests for quotes,
Number of individuals currently logged-in to a particular market, and
Identity of those individuals.

Principle 3. The system sponsor should be able to demonstrate to the regulatory authority the order execution algorithm used by the system.

The term "algorithm" refers to the set of rules entered into a computerized trading system governing the processing of orders. It includes rules for matching, prioritization and execution of orders and secondarily for disclosing for each transaction the identity of the parties, the execution price, the quantity, and the time at which the transaction occurs.

A review of the proposed algorithm is a key factor in assessing whether a computerized trading system would promote the broad objectives of fairness and efficiency because the algorithm performs the same function as trading rules in a floor-based trading system. A competitive algorithm can increase the potential that the pricing mechanism will reflect accurately the prevailing market prices at any particular point in time, thus decreasing the potential for improper practices in relation to the execution of customer orders.

In reviewing an algorithm, the regulatory authority should keep in mind the availability of information about current orders and transactions in the system and should judge what degree of disclosure is relevant in each case. The information which is available to participants may vary from system to system (see Box 5).

In some instances, the extent of order exposure in an algorithm may compromise the efficiency and fairness of the market. For example, systems which identify the party who places an order for execution may facilitate the pre-arrangement of trades or the abuse of customer orders in ways which are not possible where the counterparty to the trade remains unidentified. In addition, identification of a party to an order may discourage such parties from using a screen-based trading system if they are reluctant to disclose their position in the market and the order may be transacted off-market, thus fragmenting the market and reducing its price-setting efficiency. This may be true of short sellers or large institutions whose entry into the market may alter market perceptions and move prices. These considerations should be balanced against the need to ensure that sufficient information is disclosed to ensure fairness and trading efficiency of the algorithm and to allow traders to make informed judgements when using the system.

Screen-based trading systems often provide special procedures at the opening and close of a trading session, or following a temporary shut-down. For example, a system could employ an algorithm at the opening which is different from that used for the balance of the trading session. The regulatory authority should ensure that such special procedures are compatible with the rules for the balance of the session and that they are in line with the general standards and objectives set by it.

Box 6 Examples of Algorithm Approaches to Matching, Prioritization and Execution

Matching - Price Priority. Orders are executed at the best prices, but the system does not grant time priority: executions are allocated among all orders at the same price regardless of the time at which they were entered into the system.

Matching - Price/Time Priority. Orders are executed at the best price first and, for orders with equal prices, according to the time of entry.

Matching - Price/Party Priority. Orders are granted priority according to price but among orders at the same price, priority is granted to a particular category of market participant. For example, public customer orders could receive priority over members' proprietary orders, or, on the other hand, market-maker orders could receive priority over those of other participants.

Matching - Price/Quantity Priority. Orders are granted priority according to price but among orders at the same price, priority is granted according to quantity. For example, to encourage public participation small orders could receive priority, or, conversely, to encourage institutional participation, large orders could receive priority.

Matching - Price/Order Type Priority. Orders are granted priority according to price but among orders at the same price, priority is granted to a particular type of order. For instance, market orders could receive priority over limit orders.

Matching - Single Price. The maximum number of contracts possible are executed at a single market-clearing price. Such an algorithm would not necessarily have to be limited to the opening but could be employed periodically throughout the day.

Unilateral Counterparty Selection - Price Priority. Priority is given to orders at the best price but generally a party is able to select his counterparty from among those bidding or offering at that price. The party who made the original bid or offer would have no choice as to counterparty.

Bilateral Counterparty Selection - Price Priority. Orders are executed as described in unilateral selection, but, both parties must agree to execute the transaction with one another.

Counterparty Selection - No Priority. Parties select both price and counterparty. The algorithm executes orders which match as to price, quantity, and counterparty regardless of other bids and offers in the system.

Principle 4. The system should operate in a manner which is equitable to all market participants and any differences in treatment among classes of participants should be identified.

Response Time. Response time is the elapsed time between the transmission of a transaction from the system user's terminal and the receipt of confirmation from the host computer that the transaction has been accepted (or rejected due, for example, to a faulty command of the system user). The need to ensure that response times are equitable for all like classes of participants (e.g., market makers) is more important, from a regulatory perspective, than the actual response time. Under usual circumstances, equal response time is a matter which can be monitored by the system sponsor. To the extent possible, the host computer, system user installations, communication network and software should provide for equitable response times for all like classes of system users. Market participants (including system users and, when relevant, their customers) should be informed where equal treatment is not possible, including the extent of the inequality. It should also be remembered that response times that are considered adequate by traders under normal market circumstances might be perceived as insufficient under extreme market circumstances; for example, at times of high volume or high volatility. Variations in response time in different circumstances should be identified and explained at the outset and should be monitored by the regulatory authority.

Equality of Treatment. All system users should have equal ability to connect to and maintain the connection to the system. In evaluating the system in this respect, two factors should be taken into consideration: (i) the communication lines of the network and (ii) the software of the system.

In many emerging market countries, the communication lines are of poor quality and are subject to failure or disruption. Sometimes they are not available equally to all users or the quality of service differs between them. These problems should be anticipated in the system design and should be overcome to the greatest extent possible in order to ensure equality of treatment.

As for software, it should be the regulatory authority's ongoing task to verify that equitable treatment is accorded all market participants of the same class. The regulatory objective

should be to ensure that all equivalent inputs by system users (e.g., of the same volume and order type) are treated fairly and equally, so that, for example, order inputs of equivalent priority as specified in the documentation of the algorithm, are executed or processed as specified.

Interfaces to Other Systems. Computerized trading systems can interface to at least six other types of systems: (i) clearing houses, (ii) back-office systems, (iii) order-routing systems, (iv) market information systems, (v) floor trading systems, and (vi) other trading systems.

Since most, if not all, clearing house activities are automated, computerized trading systems may seek direct links with them. The interface must ensure that whatever is sent by one side is properly received by the other side. The clearing house should be able to receive the messages from the system at the same speed as they are sent and vice versa. Additionally, system sponsors, users, and administrators of interfacing non-trading systems, should be able to ascertain that all messages sent by one party are received accurately and on a timely basis by the other parties. Although these objectives may be of interest to both the system provider and the clearing house, they must be significant concerns for the regulatory authority also because of their equity and system stability implications.

Links also can be established with broker back-office and order routing systems. Such links can facilitate the crediting and supervision of customer accounts and the settlement of trades but can cause major disruption if they fail. Because there are often a large number of custom made and proprietary systems in use within the one market, uniform efficiency and stability is difficult to ensure. The systems should therefore be reviewed to identify potential vulnerabilities or inefficiencies at normal transaction loads and peak loads when failure is most likely and most disruptive. Where vulnerabilities are identified, the regulator should ensure their removal.

In some circumstances, an exchange may employ a computerized system for commencement of trading or continuation before or after normal trading hours on a floor-based manual market. In such cases, procedures must be established and disclosed to system users for moving open orders in an equitable way from the floor to the screen-based trading system and vice versa.

Computerized trading systems also provide the opportunity for links with other computerized trading systems. The efficiency of such interfaces with respect to capacity,

accuracy and speed of transmission should be reviewed and particular attention should be paid to the effects of such a link on the operation of each system's algorithm. Care should be taken to ascertain that transactions entered in the network of one system intended for execution in a linked system do not provide special opportunities for abuses of the rules of either system or breaches of the applicable law.

Principle 5. Before implementation, and on a continuing periodic basis, the system and system interfaces should be subject to objective risk assessments to identify vulnerabilities in the system design, development, or implementation (e.g., the risk of unauthorized access, internal failures, human errors, attacks, and natural catastrophes).

System sponsors and the regulatory authority should ensure periodic review of the safeguards which protect a system against unauthorized access, internal failures, human errors, attacks and natural catastrophes that might cause improper disclosures, modification, destruction, or denial of service. This review should include the physical environment, system capacity, operating system software, data integrity, access controls, systems testing, documentation, internal controls and contingency plans and other safeguards which require incorporation into the design of the system.

To avoid inhibiting innovation, the regulatory authority should develop guidelines for system review rather than standards of design. The review should be objective and independent: those parties responsible for the development or operation of the system should not be the same individuals who conduct the review. The purpose of the review should be to identify vulnerabilities that may exist so that they may be assessed and addressed prior to the occurrence of a failure of the system. Box 7 briefly describes areas which should be addressed in such reviews.

The system should be designed, built and operated in such a way that the risk of down-time is reduced. The system design should include the duplication of power supply and other central components such as mainframe hardware, peripherals and communication lines. In case of a complete catastrophe, a fall-back computer site must be available and a disaster recovery plan well defined and rehearsed.

Box 7 Risk Review Parameters

Physical Environment. The physical environment of the communication facilities and central computer data center should be inspected, as should representative system user terminal sites. The regulatory authority should be satisfied with the adequacy of safeguards for the protection of each component of the system. The configuration of the system (that is, the main computer system and network) should be reviewed to identify potential points of failure, lack of back-up, and redundant capabilities.

Capacity. The capacity of a system is usually defined in terms of the number of transactions the system can process per unit of time, e.g., transactions per second. The regulatory authority should be satisfied with the methodology employed to determine the adequacy of system capacity, and should test on a periodic basis the capacity of the system to handle average and projected peak volumes.

Operating System Software. The regulatory authority should evaluate the computer operating system software used. All inherent weaknesses of the operating system software should be identified and any countermeasures taken to neutralize the known weaknesses should be documented and tested.

Data Integrity. The trading system should be fault-tolerant and preserve the integrity of data once it is entered. The procedures associated with file handling and back-up and recovery should be adequate for peak load demands when systems are most vulnerable.

Access Controls. The controls and procedures to insure the identification and authentication of system users' terminals and users should be reviewed (e.g., use of the passwords and user codes and other means of ensuring that access is possible only through an authorized terminal by an authorized system user).

Systems Testing. The systems testing process should be reviewed to ensure that all functions and subsystems (including the algorithm) have been tested. The testing should include system operation and all interfaces to external systems such as those used for market information, audit trail, surveillance, and clearing. Spot checking of test outputs should be included.

Documentation. The system sponsor and provider should maintain documentation which describes the system and its operation completely and accurately.

Internal Controls. Internal controls and procedures used to ensure the operation and security of the screen-based trading system should be reviewed. At a minimum, controls should exist for configuration management (e.g., planning for hardware changes); software changes (including separation of function procedures); problem identification, reporting and resolution; system start-up and shutdown; system restarts; and disaster recovery.

Contingency Plans. The regulatory authority should review contingency plans to respond to major failures or catastrophes. System break-downs are not limited to hardware failures; they can occur because of hardware problems, software deficiencies, human errors, sabotage and natural catastrophe.

Box 7 (Cont.) Risk Review Parameters

A balance must be struck between the risks of breakdown and the costs of minimizing those risks. Maintenance, replacement or catastrophe back-up agreements with hardware vendors may assist in reducing the risk of hardware failure to a minimum. Software deficiencies are of particular concern and thorough testing procedures are necessary. In addition, where software development or enhancements use assumptions which prove inadequate, the system sponsor or system provider should have procedures in place to make adjustments and corrections on a timely basis. It is imperative that all software programs are properly documented, that the documentation is available to the relevant authorities and system personnel and that the system sponsor or the system provider is staffed with persons with the skills necessary to handle software and other failures.

Adequate procedures are required to ensure that the impact on the system of any human error is minimal. As communication occurs by electronic messages and is highly impersonal, trading on screen-based systems isolates users from the system sponsor and its personnel. The system sponsor should ensure that there is adequate opportunity for dialogue between itself and system users so that each may benefit from knowledge about the system in operation.

Finally, catastrophe procedures which are designed to be used during or after a failure and before the full recovery of all of the components of the primary system is achieved should be adequate and clearly described. Procedures for treatment of orders which are in the system before the failure should be clearly established. And there should be express agreement as to the allocation of liability for losses resulting from system failures.

Principle 6. Procedures should be established to ensure the competence, integrity, and authority of system users, to ensure that system users are adequately supervised, and that access to the system is not arbitrarily or discriminatorily denied.

Access. Computerized trading systems have the potential to increase the degree of direct access to a market well beyond that which is normally available on floor trading systems. For example, computerized trading systems are not subject to the same physical limits in relation to the number of traders on the floor which exist in traditional stock exchanges. Also, unlike floor trading systems, computerized systems permit system users in diverse locations to execute transactions without going through intermediaries on the exchange premises. For these reasons, adequate and well supervised standards for use of and access to the system should be approved by the regulatory authority. Such standards should be written in such a way that access to the system is not denied in an arbitrary or discriminatory way.

Box 8 Guidelines On Access

Access should be restricted to adequately trained system users who have demonstrated competence in the functions they must perform.

Access should be restricted to users adequately vetted as to authority, integrity and fitness.

Consideration should be given to whether qualification standards should differ for different categories of users, e.g., those doing proprietary business versus those doing customer business.

Brokerage firms and the regulatory authority should make arrangements for, and devote sufficient resources to, the adequate supervision of access to the system, and the activities of all authorized users and other operators.

The regulatory authority should make adequate arrangements for, and devote sufficient resources to, the monitoring and enforcement of compliance with access and use restrictions.

Adequate arrangements should be in place governing the security of terminal locations.

Principle 7. The regulatory authority and the system sponsor should consider any additional risk management exposures pertinent to the system, including those arising from interaction with related financial systems.

Financial Integrity. Computerized trading systems may increase financial risks by increasing access to users other than traditional intermediaries and by extending trading hours. However they could also provide an opportunity to reduce certain risks by decreasing the number of failed trades through providing a direct interface with clearing systems, and permitting credit controls or position limits to be programmed into the system. Issues in relation to clearance and settlement are dealt with in more detail in a separate section below.

Increases in Risk. The increase in the number of market participants with direct transaction execution capability which is possible in a computerized trading system could create additional risks for clearing members and, ultimately, the clearing house. Further, an important feature of computerized trading is that it facilitates continuous 24-hour trading. This may imply greater trading volumes and an increase in the number of transactions executed when the banking and payments systems are closed ("out-of-hours" transactions). Each of these developments will test the robustness of existing clearing and settlement systems. The regulatory authority must assess whether current financial resource requirements for clearing members and clearing houses are adequate to meet these financial risks.

Risk Reduction. Computerized trading systems allow a reduction and monitoring of risk not generally available to floor-based systems. For example, screen-based trading systems are structured to eliminate or greatly reduce failed trades which expedites clearing and settlement and reduces the financial risks incurred by brokerage firms in connection with carrying uncleared trades. In fact, screen-based trading systems can be designed to interface directly with clearing systems. This could reduce risk by allowing market participants and relevant regulatory authorities to obtain position reports more quickly and, therefore, to assess risk exposure at an earlier point in time. Computerized trading systems could also facilitate the automatic enforcement of compliance with individualized position limits or credit controls by programming such restrictions into the system.

Principle 8. Mechanisms should be in place to ensure that the information necessary to conduct adequate surveillance of the system for supervisory and enforcement purposes is available to the system sponsor and regulatory authority on a timely basis.

There are three general issues that need to be considered in designing the surveillance features of a computerized trading system: (i) what types of information should be collected; (ii) what entity is to perform the actual surveillance functions; and (iii) how surveillance information is to be shared. Although screen-based systems may contain regulatory enhancements such as better audit trails and credit controls, such systems do not obviate surveillance and supervision. In addition, such systems may create the need for on-line access for surveillance purposes. This topic is discussed in a separate section on market supervision and surveillance.

Principle 9. The regulatory authority and system sponsor should ensure that system users and customers are adequately informed of significant risks particular to trading through the system. The liability of the system sponsor or provider to system users and customers should be described, especially any agreements that seek to vary the allocation of losses that otherwise would result by operation of law.

Computerized trading may reduce some of the risks of trading but they may also pose other unique risks of which customers should be made aware. For instance, because some systems may be completely order-driven, without any market-maker obligations, a significant period of time could elapse before a "matching" order is entered into the system. This exposure to the market may allow competitors to disadvantage the position of the exposed trader.

Similarly, where the system does not provide a means to execute complex trades such as basket and block trades, customers should be made aware that it may be considerably more difficult to implement such strategies which in turn may impair their risk hedging and arbitrage abilities. In addition, computerized trading systems, in contrast to exchange floors, rely entirely on the functioning of the automated system. The impact of a system failure may be much greater in a screen-based trading environment.

There should, therefore, be full disclosure of:

the order execution algorithms of the system;

any rules governing allocation of liability for losses from system malfunction or operator error;

any limit order protections for system orders;

the interrelationship, if any, between such screen-based trading sessions and exchange floor trading sessions;

any provision for cross-exchange access; and

any choice of legal provisions and process governing disputes arising in connection with trading in the system.

Principle 10. Procedures should be developed to ensure that the system sponsor, system provider, and system users are aware of and will be responsive to the directives and concerns of the regulatory authority.

Generally, markets are subject to well-defined regulatory requirements. Changing from a floor trading system to a screen-based trading system usually should not require major changes in the relationships between a market sponsor such as a stock exchange and its regulatory authority. If, however, a market sponsor contracts with an independent entity to provide certain

key functions in connection with a computerized trading system, existing law may not adequately provide for or address the role of this provider. Regulatory authorities should develop procedures to ensure that such system providers are responsive to regulatory concerns.

In the first instance, the regulatory authority should continue to rely on its existing authority over the system sponsor. For example, the regulatory authority might direct the system sponsor to obtain from the system provider information in its custody which is relevant to the performance of the regulatory authority's responsibilities. The regulatory authority would be able to review the relationship between the system sponsor and the system provider and hold the system sponsor accountable for the responsiveness of its contractor.

In other cases, however, the regulatory authority may need to develop procedures for dealing directly with system providers. Conducting a review of computer security, for example, might require direct access to the system provider's facilities. Similarly, the regulatory authority may wish to impose requirements relating to insider trading and other market abuses which can arise from the use or disclosure of non-public information by employees of the system provider.

Conclusion

These ten principles provide a basis for evaluating or supervising trading systems which include an IT component. They are designed to help policy makers and regulators focus on the key issues in seeking to achieve the basic market objectives of efficient, fair and stable trading. They focus on transparency of information and action, equity of access, and system operational efficiency and security.

The principles are of necessity general in nature and must be attuned to specific local requirements. They do not provide set answers -- the circumstances of each situation will demand a different answer. As a consequence, the principles provide a guide for the exercise of judgement by securities market regulators in their particular context and do not reduce the need for sound judgement based on local knowledge.

IV CLEARANCE AND SETTLEMENT

If trading is at the heart of a securities market, then clearance and settlement are the veins and arteries. Each executed trade is completed only after shares are exchanged for payment. As a consequence, the way in which the clearance and settlement process is organized has a great impact on the efficiency, fairness and stability of the system as a whole.¹¹

Clearance and settlement consists of four post-trade functions: trade comparison and confirmation; netting and calculation of obligations; exchange of securities and payment; and registration of title. The last is not strictly part of clearance and settlement but is commonly linked to it.¹² It can be seen that important contractual obligations and rights to title are involved in the process of clearance and settlement, and when it is remembered that many transactions must be cleared each day, the importance of efficient and reliable systems is obvious. IT solutions have been found to be effective in many situations.

Proposals by the Group of Thirty regarding minimum performance requirements for clearance and settlement have been the starting point for a great deal of work in developed countries upgrading and reorganizing existing systems. In emerging markets too, clearance and settlement has received wide attention and two emerging market countries--Mexico and Korea--are considered to have world-class clearance and settlement systems which meet virtually all The Group of Thirty requirements.¹³

Because many of the policy consideration described above in relation to trading systems are to a degree "generic", they apply equally to computerization of clearance and settlement systems. On the other hand, the Group of Thirty's proposals add considerations specific to clearance and settlement. To account for this, after describing the main functions of clearance and settlement, this

¹¹ See for instance DeGennaro, "The Effect of Payment Delays on Stock Prices".

¹² Readers unfamiliar with securities markets should consult Annex I which describes the total securities market process.

¹³ Group of Thirty, Clearance and Settlement in the World Securities Markets.

section deals with the policy issues by reference to the principles described for trading systems and The Group of Thirty proposals.

Box 9 Clearance and Settlement of Securities Transactions

A clearance system determines what securities trading counterparties owe and what they are due to receive. It consists of comparison of the details of a trade as reported by each party to determine if they agree, and then calculation of the amount owed to each. Clearance is followed by settlement - the exchange of securities and funds to complete the transaction. There are three types of clearance and settlement system: (i) trade for trade; (ii) daily netting; and (iii) continuous net settlement.

Trade for trade is the most fundamental form of clearance. The buyer ensures that cash or a cash equivalent is available for the seller and the seller ensures that the securities are held in deliverable form. The two then exchange securities and funds through some agreed mechanism. The identity of the counterparty is known and exposure to various counterparties can be monitored. But because the trade for trade system generates one long chain of trades, settlement conditions have to be fulfilled at every link in the chain for it to hold: when one transaction collapses, others are affected.

Where trading volume is large, some form of netting system is needed to reduce the number of clearance transactions required and therefore reduce the likelihood of failed transactions passing down the chain. The simplest form is daily netting, of which there are two types: (i) bilateral; and (ii) multilateral. Under bilateral netting each party has one net clearance a day with each counterparty. Multilateral netting nets the transactions in each security so that parties have one net clearance a day covering all buys and sells in that security.

Continuous net settlement is a refinement of multilateral daily netting in which daily netting is employed and all open transactions at the end of the day are offset against the next day's trades. One of the major elements of the system is that a clearing agency interposes itself between the counterparties, becoming itself the counterparty to each transaction. Individual parties to a trade are thus protected. Continuous net settlement may be on a "rolling" or an "account day" basis. In the latter all trades in a certain period settle on a specific day while in the former all trades settle a set number of days after the day they are transacted.

The exchange of physical share certificates adds to the complexity of the settlement process and makes it more difficult to obtain the maximum efficiency gains possible. For this reason, some form of book entry settlement is desirable in which credit, debit and balance records are taken as sufficient evidence of title to securities and physical transfer of securities is minimized or eliminated. This may be achieved in two basic ways: (i) immobilization; or (ii) dematerialization. In the first, share certificates are retained but are held in a central depository; in the second share certificates are completely eliminated.

Payment too may be by book entry debits or credits (electronic funds transfer) rather than by exchange of cheques or other instruments. This has the advantage of avoiding possible failure to honor cheques or delays in the clearance of cheques.

Annex V provides a more detailed description of approaches to clearance settlement.

Main Functions

Comparison. The importance of establishing timely, efficient and rigorous trade comparison can hardly be overstated. The lack of such systems greatly increase the number of failed trades and the risk of failure in the securities processing cycle.

Failed trades can become a great problem—the New York Stock Exchange had to regularly close or cancel trading sessions in the late 1960s because the build-up of unsettled and failed trades had grown so large that the financial soundness of brokers was threatened and clients were losing confidence in the market.¹⁴

Many types of comparison system are in use around the world. Some markets use electronic matching, whereas others are completely manual. Some comparison systems facilitate settlement, while others function more as an audit trail after settlement to resolve unsettled obligations. The breadth of participation is an important determinant of the level of automation and the features included in a particular system.

Box 10

Comparison Criteria

Matching of trades through comparison and agreement on the following key data is an essential risk reducing element in clearance and settlement:

- date of trade
- time of trade
- market in which the trade was executed
- specific identification of security traded
- number of shares traded and face value
- execution price (and currency if relevant)
- counterparty (and clearing broker if different)
- buy/sell instructions
- trade conditions (ex or cum dividend, etc.)
- projected settlement date
- trade identification number (a sequential identifier, not always used)
- as well as information required for matching, some systems also include audit trail information to facilitate market surveillance

¹⁴ Congress of the United States, Electronic Bulls and Bears, p. 109

Trade Resolution. When trades are compared and successfully confirmed the process flows smoothly, but resolving unmatched trades is a test of the effectiveness of a comparison system. Depending on the system, trades at various times in the cycle may be either corrected or canceled.

In a simple comparison system, corrections can be made by either counterparty after each has examined reports reflecting the results of the computer matching process. The brokers contact one another directly to resolve discrepancies. Unfortunately the system can stall at this point. Brokers with inefficient operational procedures may neglect to resolve un-compared trades, even though the system repeatedly notifies them of the outstanding problem.

Two approaches are used to enforce compliance in this situation. First, some markets do not allow unresolved trades to remain on the list past settlement day (or even passed two days before settlement day) and force an unwinding of the transaction either automatically or by manual intervention, often at a market loss to one or other party. The second approach is by use of a fully on-line system linked directly to the trading system in which mismatches are identified seconds after the transaction and are resolved with 100% certainty within minutes. This is called a "locked in" trade.

Calculation of Obligations. Following matching of all trades a clearance system determines exactly what counterparties owe and what they are due to receive on settlement date. By accounting for the obligations of different counterparties, the clearance process allow funds and securities to change hands in an accurate and efficient manner. The obligations may be calculated on a variety of basis but the trend is clearly toward rolling net settlement with the participation of a central clearing and settlement organization. This minimizes the movement of both cash and securities.¹⁵

Exchange of Value. The ultimate test of a clearing and settlement system is its capacity for payment of obligations. Whether linked to computerized trading or not, the clearing house must have the capacity to speedily and accurately transfer title to securities and make the balancing cash payments (called delivery versus payment or "DVP"). IT systems have made possible very rapid and accurate processing of this function by relying on "book entry" transfer and payment. Several proprietary systems are available and can be scaled up or down to meet market needs. For example, the Mexican INDEVAL system is being marketed, as is the Australian Austraclear system. Such systems are relatively low cost.

Payment arrangements may be subject to additional pressures when linked to computerized trading systems. The most important such pressures are out-of-hours and 24 hour trading. In these

¹⁵ See Annex V, pp. 2-6 for a full description of netting processes.

circumstances the relevant regulatory authorities reviewing computerized clearance and settlement systems should assess the extent to which appropriate banking arrangements are in place to back up the payments obligations generated. For example, special arrangements may be necessary to accommodate the transfer of funds during hours when banks would normally be closed.

Registration. "Book entry" registration is the optimal solution to speedily concluding the clearance and settlement process. It is the extension of the electronic transfer process to the legal registration of title and is a natural development from computerized clearance.

Box 11

Settlement and Securities Administration in Mexico

The institution responsible for clearing trades in Mexico is S.D. INDEVAL*, S.A. de C.V., an organization which also acts as the central securities depository. INDEVAL was initially a government corporation but was sold to the private sector in July 1987. All securities placed through public offer may be accepted for custody. The services offered are:

- Safe custody and administration of securities.
- Clearance of transactions made within the stock exchange.
- Daily statement of movements and balances of deposited securities.
- Collection of principal and revenue at maturity of bonds or dividends on stock, paying out to the depositors the same day the amount is collected.
- Certificates of position for exercising voting rights at assemblies.
- Services to issuers, such as payment of dividends, subscriptions, stock dividends, exchange of certificates, keeping the stockholders register, etc., on behalf of the issuers, under specific agreements.

On the Mexican Stock Exchange transactions are "locked-in". That is to say they are settled exactly as they are recorded at trade. This makes it unnecessary to have a system for comparing data on the transactions, as this is understood in other markets in other parts of the world.

INDEVAL receives from the Exchange the information on the day's transactions, processes and clears them by crediting the balance of all of them in the position accounts of every stock firm involved. As all the securities are "endorsed in administration" in the name of INDEVAL when deposited, there is no need to make any changes in the physical certificates.

When a broker sells a larger quantity of a security than its real position, INDEVAL, being both the clearing and depository organization, may credit the complete amount of the transaction to the buyer, but fines the seller the equivalent of 1% of the missing securities' market value for the first day, and 0.1% for each subsequent day. Usually, it only takes one day for brokers to cover their short positions.

Transfer of funds is carried out by the Mexican Stock Exchange which, by electronic means, charges or pays, as the case may be, the amount corresponding to each stock firm's balance. Securities must be paid the same day they are transferred. If any of the parties find a mistake on a settled transaction, it has the right to ask for a correction.

* Instituto Para El Depósito De Valores

Box 12 Settlement and Securities Administration in Korea

The Korea Securities Settlement Corporation ("KSSC") was created in December 1974 to operate as the sole central depository for securities and to serve as the clearing house for the settlement of transactions conducted on the floor of the Korea Stock Exchange (KSE). The KSSC also acts as transfer and paying agent for issuing companies listed on the KSE and the OTC market. In its role as central depository, the KSSC provides safekeeping for more than 60% of all listed shares. The services offered are:

- safekeeping of deposited securities
- book-entry delivery of securities on deposit
- book-entry pledges of securities on deposit
- collection and payment of dividends on deposited securities
- book-entry delivery of securities between participants
- separate safe custody service(Individual Custody)
- collection and payment of principal and interest on deposited bonds
- checking of securities deposited against list of stopped securities
- physical receipt and delivery of securities from/to participants
- settlement of transactions made on the floor of the KSE
- administration of beneficial owner's rights
- exercise of various rights associated with the consecutive deposit of securities
- transfer agent for registered shares
- sub-conversion agent for Korean overseas securities
- nominee function
- collection of securities transfer tax
- conversion of convertible bonds

The KSE provides an automated comparison system for its members who are counterparties of a trade, so that they may confirm the details of their trading commitments just after contracting trades. As there are very few unmatched or rejected trades under this system, the KSE has little need for a secondary trade comparison system. Additionally, the Data Correction System checks the overall format of all input thereby identifying major errors so they can be corrected immediately.

The KSE proceeds with multilateral netting based on the integrated trade data determined after the matching process is complete. The traded quantities are netted to a final long or short position by issue and securities companies who are counterparties to a trade.

The netting data is forwarded to the KSSC via magnetic tape to enter into its own computer. Then, after identifying the position in the participant's account book, the KSSC distributes details in a report to the securities companies, concerned for settlement by the time limit for settlement. The KSE has entrusted the settlement of funds to the KSSC which executes delivery against payment, simultaneously effecting the delivery of securities and the payment of the corresponding proceeds.

Policy Considerations

General. As with trading systems, the underlying objective is to ensure that securities clearance and settlement takes place in an efficient, fair and stable manner. Several of the same policy principles apply in assessing computerized clearance and settlement systems as in trading systems. For example, computerized clearance and settlement systems must be highly reliable and secure because they contain a database of market price movements, and securities distribution and corporate action information (payment dates for dividends, etc) which must be processed smoothly and accurately. Those of the principles enumerated in Section III in relation to trading systems which are particularly relevant to clearance and settlement are briefly listed below. Refer to the trading systems section for discussion of each one:

- Principle 1 The system should meet all applicable legal standards;
- Principle 2 The system should be designed to ensure the equitable availability of timely information to all participants;
- Principle 4 The system should be designed to operate in a manner which is equitable to all participants and any differences in treatment among classes of participants should be identified;
- Principle 5 Before implementation and on a periodic basis thereafter, the system and system interfaces should be subject to objective risk assessments to identify vulnerabilities which may exist in the system design, development or implementation (e.g., the risk of unauthorized access, internal failure, human error or natural catastrophe); and
- Principle 7 The regulatory authority should consider any additional risk management requirements arising from interaction with related financial systems.

Group of 30. Arising from the work of Group of 30, nine proposals specific to the operation of efficient clearance and settlement systems have been developed. They have been endorsed by all major securities markets and considerable effort is being expended on bringing systems up to the standards proposed. The G30 proposals are described below and the relevance of automation to achieving the performance standards is discussed.

Proposal 1 All comparisons of trades between direct market participants (i.e., brokers and other exchange members) should be accomplished by the first business day after trade day (T+1).

Lack of timely, efficient and disciplined matching systems is one of the most risk prone components of the securities processing cycle. A comparison system must ensure that all non-matching trades are returned for resolution promptly. Comparison on T + 1 (i.e., one day after the day of the trade) gives the trading parties opportunity to correct discrepancies or conflicts in order to minimize risk in the settlement system and help ensure timely settlement.

An efficient comparison system is typically operated by a stock exchange so that both parties to a trade may input data directly into a central automated matching system, which then automatically compares the trade. The basic features of such systems are:

- Trade detail reporting to counterparties
- Trade matching capability
- Trade error resolution capability
- Ability to "lock in" trades that match

In order to ensure that the T + 1 standard is met, the system must be designed so that trade reporting back to participants is accomplished on the night of trade date or the morning of T + 1 but no later than T + 1. Such reporting may be by paper delivery or electronic batch or real-time transmission of data. In all cases the regulator must ensure that the system has sufficient capacity and equitably treats all participants.

Proposal 2 Indirect market participants (such as institutional investors, or any trading counterparties which are not broker/dealers) should be members of a trade comparison system which achieves positive affirmation of trade details.

Where institutional investors and large traders are dominant the lack of a uniform and disciplined trade confirmation capability among them introduces a significant element

of risk and inefficiency into the securities processing cycle and so a limited form of institutional participation is beneficial. Such systems are called "one-sided" to distinguish them from the "two-sided" comparison achieved between direct members of a clearing house.

One-sided comparison systems exist for institutional investors who may not wish or be permitted to join a two-sided comparison system associated with an exchange because they may be unwilling or unable to participate in a risk sharing arrangement, such as that typically found in two-sided comparison systems. They may, however, wish to have access to an automated comparison system which links them, their broker, and their operational agent (such as a custodian bank) in order to receive a timely and accurate list of trades to which they are the counterparty. This allows the institution to affirm or question the trades within an established time frame.

These systems require communication systems capability which tie the participants together. The most efficient system will require a high degree of automation, with all participants having on-line, real time access to information, such as clearing and settlement data (to manage positions) and accounts (to manage cash). The regulatory authority should ensure that the system is capable of reliably fulfilling this expanded role.

Proposal 3 Each country should have an effective and fully developed central securities depository, organized and managed to encourage the broadest possible industry participation.

A Central Securities Depository's ("CSD") principal function is to immobilize or dematerialize securities, thereby assuring that the bulk of securities transactions are processed in "book entry" form. The depository system provides the basis for achieving efficient and low-risk transaction settlement. The most important feature of the book entry method is that a transfer of a given quantity of an issue from one account to another can be effected by a simple debit or credit on the books of the CSD. This is inevitably done via computer data entry.

The CSD may also have the capability for trade clearance, safe custody, and settlement/post-settlement processing of securities and information, such as corporate actions and dividend/interest processing. All these functions are greatly facilitated by automation.

CSDs can also be structured to include a payments system maintaining cash accounts for their members, or they may be linked to a separate payments system. In the former case, the CSD automatically processes a payment transaction by crediting or debiting the cash account of the member financial institution simultaneously with processing the securities side of the transaction. This two-sided process assures that each security transaction is, in fact, "delivery versus payment", a key ingredient in limiting risk in the settlement process.

The regulatory authority should require clear specification of the data transmission and recording techniques to be used and ensure accuracy of the records kept through regular balance calculations (usually two or more a day) and periodic audit (usually monthly).

Proposal 4 Each country should study its market volumes and participation to determine whether a trade netting system would be beneficial in terms of reducing risk and promoting efficiency.

For high-volume markets with a high concentration of transactions among participants, some form of netting of transactions and clearance of trades between and among market participants can minimize risk and cost. The alternatives should be analyzed in terms of the cost of building and maintaining a net settlement system, set against the cost of settling trades without such a system.

In multilateral and continuous net settlement there is a need for some form of risk sharing and trade guarantee system, since the counterparty in each of these cases is changed, either to a new counterparty, or to the clearing corporation itself. These two types of netting are especially efficient and economical in high volume marketplaces where IT capacity to support the volume can be funded.

Bi-lateral netting in which all trades in the same security between the same counterparties are netted to a final delivery versus payment are not as complex or costly and are suitable for lower volume markets which can support simpler IT installations.

The regulatory authority should carefully consider the market's medium term efficiency goals and determine its own view of what form of netting is appropriate. Whichever form is chosen, the authority should be assured that the system is capable of handling likely peak loads and treats like participants equally.

Proposal 5 Delivery versus payment (DVP) should be employed as the method for settling all securities transactions.

An area of substantial risk in the settlement of securities transactions occurs when securities are delivered without the simultaneous receipt of value by the delivering party. Simultaneous exchange of value is important to eliminate the risks of price change and failure to perform according to contract. DVP effectively eliminates any exposure due to delivery delay by a counterparty. The most efficient and certain DVP occurs by automatic simultaneous transfer of title to securities and debit or credit of cash accounts.

The electronic transfer of funds against book entry delivery of securities raises the prospect of direct links to the banking system and the rapid flow of substantial funds. For this reason alone the system must be made secure.

Proposal 6 Payments associated with the settlement of securities transactions should be made "same day funds".

Various methods of payment are used for securities settlement and portfolio servicing. In many markets what is referred to as "same day funds" are used, in others what is referred to as "next day funds" are used. Same day funds are payments made and received free of lien and immediately available on the same day as the corresponding transfer of securities.

Adoption of the "same day" convention will increase the efficiency of the accounting and payment systems. Consistency will also simplify the movement of payments systems towards full automation of DVP which typically operates with same day funds.

Each country should examine the feasibility of linking the clearing process with an electronic cash clearing system. All types of transactions could be paid through an electronic cash clearing system. Eliminating cheque drawing in this way will promote greater efficiency and reduce risk.

Proposal 7 A "Rolling Settlement" system should be adopted by all markets. Final settlement should occur on T + 3 (as an interim target while systems are upgraded, final settlement should occur on T + 5).

In a rolling settlement environment, trades settle on all business days of the week. This process limits the number of outstanding trades, thus reducing market exposure. Rolling settlement, even of small volumes, is facilitated by simple automation.

The primary objective is to shorten the delay between trade date and settlement date; the secondary objective is to standardize settlement time frames throughout international markets. These two goals are best achieved through efficient automation of the settlement process. In fact in an environment which is totally centralized and automated, same-day settlement is feasible as is demonstrated in Mexico and Korea.

Proposal 8 Securities lending and borrowing should be encouraged as a method of expediting the settlement of securities transactions. Existing regulatory and taxation barriers that inhibit the practice of lending securities should be removed.

Despite all efforts made to clear and settle securities transactions in a time frame consistent with the recommended standards, failures to deliver can occur if securities are not available. Securities borrowing has become an effective tool used by market participants to satisfy their obligation to deliver to a trading counterparty in this situation. At the same time, these borrowers incur a temporary collateralized obligation to a lending party.

However, in markets where the practice of securities lending and borrowing is new, precautions must be taken to ensure that borrowers and lenders protect themselves from undue risk in these transactions by instituting careful credit standards, contract terms, and practices. Emerging market regulators should carefully consider the risks associated with securities lending and permit its use only under controlled conditions.¹⁶

¹⁶ See Group of Thirty, Clearance and Settlement, pp. 47-49 and 58 for a discussion of the risks of securities lending and concomitant safeguards required.

In addition, securities on loan should be marked-to-market (priced at current market value) at least on a daily basis to protect both parties to the loan. This is necessary to ensure that securities lending contributes to the efficiency of trade settlement and in no way increases risk to institutional lenders.

Mark-to-market revaluation is greatly facilitated by computerization as is monitoring of credit standards and maintenance of an accurate securities inventory.

Proposal 9 Each county should adopt the standard for securities messages developed by the International Organization for Standardization [ISO Standard 7775].

No worldwide securities numbering system currently exists but for trade information to be communicated in a consistent format and handled by computers, a single numbering standard and message system would be ideal. Such a system is provided by the international ISO Standards 6166 (International Securities Identification Number ISIN) and 7775 (Securities Message Types). The ISIN number consists of a country code, a security's domestic code number, and a check digit to validate the code.

In emerging markets newly computerizing clearance and settlement it would be appropriate to adopt the ISO and ISIN systems from the outset. The reality today is that substantial investments have already been made in the infrastructure of various systems that use their own numbering and message systems. Options thus include either a conversion to the ISIN numbering system immediately, or the construction of tables that uniquely translate from an existing numbering/message system to the ISIN numbering system and ISO message format.

Conclusion

The post-trade process of clearing and settling transactions is a crucial part of an efficient securities market. Because of its importance, internationally agreed standards have been proposed by the G30 which seek to ensure efficient, fair and stable clearance and settlement systems. These and the relevant principles described in relation to trading systems emphasize operational efficiency, financial stability and contractual certainty. Policy makers should consider the relevance of the G30 proposals to their situation and to what extent automation may be necessary. The G30 goals and relevant principles from the discussion of trading systems can be used to guide their analysis of local needs.

VI CONCLUSION

There are many ways of structuring and operating secondary securities markets; the diversity arising largely from legal and institutional arrangements, and commercial custom and practice peculiar to each place. Also, in the last decade, further diversity has been added by the impact of computerization. It is not simply that computerization has brought new techniques for performing securities market tasks. Rather, it has tended to change the rights and obligations of market participants, the way they relate and conduct their business, and even the way the securities market is organized and defined.

In emerging market countries, the extent of computerization and its consequent impact varies from place to place but is already far reaching: in Mexico or Korea for example, advanced systems are in place and extensive institutional and legal change has accompanied their introduction; in Turkey, a reform program has begun which includes a sequenced computerization program; and countries as diverse as Russia, Egypt, China and Colombia are considering how to make use of IT to build from a very low base to a securities market infrastructure which can support the high growth in trading expected in the medium term.

Through the 1990s it seems likely that emerging securities markets will make increasing use of computer assistance. Many of them have ambitious privatization programs and other policies likely to lead to a substantial growth in the number of securities listed and traded on the markets. To be successful, this growth will often require considerable improvement in the efficiency, fairness and stability of the markets. Two factors will tend to encourage increased computer assistance as the solution. One is the cost reduction and simplification which is occurring of many of the systems designed for securities market tasks, and the other is the tendency for standards of operational performance to converge because of the increasingly international nature of securities trading.

As a consequence, Bank staff and securities market supervisors devising institutional and regulatory reform programs will be increasingly called on to take into account the opportunities and problems that computerization brings. This does not mean that every reform program should emphasize computerization or that its importance will be equal in all places. On the contrary, the focus of reform should be on achieving the basic goals of efficient, fair and stable market operation. This will usually

mean dealing with computerization questions, but the goals should lead the technology, not the other way round.

Efficiency, fairness and stability are goals common to all financial markets and the fundamental approaches to achieving them are the same in all markets - openness to entry and exit, low costs of intermediation, free flow of information, even handed supervision by an independent and knowledgeable body, and above all, confidence in the integrity and stability of the market itself. In the task of assessing the effectiveness of IT systems in meeting regulatory goals, these fundamentals apply just as forcefully. The principles described in Sections III and IV operationalize them for IT assisted trading, and clearance and settlement. They are intended as a guide to best practice in the regulation of computer assisted securities markets and, as such, as a reference point rather than as a prescription.

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OPERATIONAL FUNCTIONS OF SECURITIES MARKETS

Securities market activities may be described in terms of a series of fourteen operational functions grouped into several processes, each of which is amenable to computerization. This annex sets these out in order to understand the functions, the different options for the performance of each and the relations between them, and the factors which tend to encourage or discourage computerization of each.

Order collection and maintenance of client records. Often referred to as 'back office operations, these two functions are usually performed by brokers. Order collection can be thought of as the starting point of a transaction in which a broker receives instructions from a client and notes those instructions either in writing or direct to a computer record. The main client records kept are a record of client instructions regarding transactions, ledger entries of money and security transfers and balances, the name in which securities are registered and the location and form in which they are held, any liens or charges over the securities and details of any authority or power vested in the broker by the client relating to the client's assets. Traditionally all these records have been kept manually but are now computerized in all but the smallest broker's office. They are amenable to computerization via a P.C. and simple software.

Order routing. This is the first step of the transaction process outside the broker's office. It is the process of transmitting a client's order to the correct place for execution. This might be to the broker's trading representative on the floor of a local or distant stock exchange, to an automatic small order execution system, or to an off-exchange market such as a computerized over the counter ("OTC") market or privately negotiated upstairs market. It can be done via physical delivery of an instruction slip; via telephone or computer link to the broker's booth on the trading floor and then by physical delivery or by hand signal to the trading brokers on the floor itself; by direct entry to a computer based market where the order is instantly displayed; or to an automated switching mechanism which selects the appropriate local or distant market in which to transact the order. Such order routing facilities are commonly provided by stock exchanges but sometimes by independent IT providers such as Reuters.

Quotation display and comparison. On reaching the trading place, a client's buy or sell orders are brought together with other orders to begin the price setting process which is the cornerstone of a securities market. They are displayed according to price priority and compared with each other to identify where a trade may be possible. In an order driven market the bid and ask prices of investors are displayed, while in a quote driven market the buy and sell quotes of market makers are displayed. At least the highest bid and offer price plus the last sell price are given, and on some computer systems,

the highest five or ten bid and asks are quoted, sometimes together with their associated buy or sell quantities. Order display and comparison systems are provided by stock exchanges or similar market operators. They may be centralized like a stock exchange floor or computer trading room, or they may be distributed on a computer network.

Order matching and selection. A deal is struck when, as a first step, a selling order is matched with a buying order and, second, the two are selected as the two sides of a trade. Matching is price based - the buy price must equal or surpass the sell price. Selection criteria are more varied and depend on the nature of the market: order or quote driven, automated or manual, continuous or call auction. One method is automatic selection by time priority, in which quotes at the same price are executed in order from the first one entered into the system to the last one entered. This is common in a continuous auction automatic execution system. A second method is where brokers exercise some discretion, so that from within a group quoting the same price, rather than having to deal strictly in time priority, they are able to trade with selected counter-parties because of the convenience of the quantities involved or because of considerations such as likely promptness to pay or deliver. This occurs to a greater or lesser degree in floor based, or computer assisted manual markets. A third approach is computer based or manual call auctions which do not account for time priority. Instead, they execute the largest possible volume of trades by calculating a single strike price derived from the bids and offers in the system at the time of the call. And finally, a quote driven market displays the bid and ask spreads of the market makers rather than bid and offer prices of investors. In this case, client orders are matched with the market maker's quote.

Order execution. A deal is struck when matched buy and sell orders are executed one against the other. This may be done automatically or manually. Manual order execution requires a decision and an action by both the buy and sell broker. The decision is acceptance of the terms of the trade and of each other as counter-parties; the action is commitment of those decisions to a permanent record of their own and of the exchange, and display of the new sale price if it is different to the last one displayed. In floor based systems, the brokers may each write a sales slip which they deposit immediately for collection by the exchange, keeping a copy for themselves, or they might each write the details in their own trade book and signal to an exchange official that the trade has been executed so that the official can also record the details of the trade. In a floor based system these actions can be supported to a greater or lesser degree by computerization. In a non-floor based system, brokers may strike a deal by communicating directly via the linked computer terminals which also display the bids and offers, or they may use ancillary telephone or fax communication; they may record their decision separately in their own records and those of the market provider or the records may be generated automatically by the computer network. Fully automatic execution on computer based systems removes the decision to consummate the

trade from the control of the brokers and instead executes the trade automatically once orders are matched.

Trade comparison and confirmation. After execution, the three records of a trade are compared to ensure that they agree. The buy and sell brokers must confirm that the trade was executed in accordance with the recorded details of the trade and the brokers also have the opportunity to check that the record of their clients' instructions match the terms of the trade. A check is also often made to ensure that the trade was in line with trading rules, for example that it took place at a fair price in relation to the prevailing market price and that it took into account information about the shares relevant to the price and the property rights attaching to them, such as announcements that a stock is cum-dividend or ex-dividend. Comparison and confirmation in an automatic execution market is done promptly by electronic checking of the data in the system and secondly by the brokers checking, usually on the same day as the trade, either electronically or manually, that the trade data in their order collection and client account records agrees with the data of the trade itself. Manual comparison and execution requires bringing together the written records of each party and is usually slower by a day or more than electronic methods. Once a trade completes the confirmation process it is declared 'firm', which means it must now go to settlement and each broker is obliged to meet its obligations to deliver or pay for securities. Trades that do not pass the confirmation process are declared 'out trades' and must be corrected or canceled by agreement between the brokers under the supervision of the market organizer.

Netting and calculation of obligations. Payment or delivery of securities between brokers is done on a net basis in all markets which trade significant volume. The alternative is to separately exchange the number of securities and amount of payment specified in each trade but this means that many such exchanges must occur. Netting involves calculation of the final amount deliverable from each broker to each other broker taking into account all buys and sells in a trading period. Netting calculations are very amenable to simple computer support.

Exchange of securities and payment. In a completely manual system, each broker delivers directly to each counter-party a bank check or cash (or cash equivalent such as treasury bills) in the amount owed and on the other side, delivers un-encumbered securities in the quantity owed. The netting calculation done previously simplifies this process by reducing it to one payment and one delivery for each security traded between each pair of brokers. It can be further simplified by interposing a separate clearing house organization between pairs of brokers. In this case even a broker who has obligations to more than one counter-party, which is the usual situation in an active market, still makes or receives only a single payment and similarly delivers or receives only a single quantity of each security. This is possible because the clearing house stands as counter-party to every trade and calculates the net position

across all the day's trades for all brokers thus reducing transfers to a single payment or delivery between itself and each broker. The broker accounts kept and the netting calculations performed by a clearing house are usually computerized and are relatively simple.

Registration of title. Further efficiency gains can be obtained from reducing the volume of paper flow involved in the transfer of title to securities. This is achieved by dispensing with the requirement for physical delivery of share certificates. In some cases this is achieved by immobilizing all (or nearly all) share certificates in a depository and so that the record of debits and credits in a securities account becomes the evidence of transfer of title to the immobilized and securely held shares. This approach still requires that if a broker's holding of a particular security in the depository is not sufficient to meet net obligations the holding must be increased by delivery of further certificates to the depository. But this will be a much less frequent occurrence than physical delivery against each net position every day. A further refinement is to dispense with certificates completely or almost completely - so called dematerialization. There are two approaches: either a single certificate is issued by a company and is held in a secured depository, or no certificates at all are issued. Both methods greatly reduce paper flow in the transfer process. Dispensing with the passing of share certificates by immobilization or dematerialization also raises important operational and legal issues. Because delivery of share certificates gives certainty to transfer of title, if it is to be done away with it must be replaced by an equally certain process. In other words, the account debits and credits of the book entry system must be accurately and securely kept and be conclusive evidence of title.

Trade data reporting. At its simplest, a report of a day's trading activity includes only the day's high, low and last sale prices and total volume traded for each security. But securities trading is an information dependent activity and the demand for timely and detailed trading information is soon felt in active markets. Real time and periodic reports on price and volume fluctuations are very important to reading market trends, as is the ability to manipulate and question the data in flexible ways. Stock exchanges sometimes provide both the data itself and the system for its dissemination but, often, independent IT providers perform the packaging and distribution functions. The systems range from simple trade by trade price and volume information lines, through to more sophisticated storage, recall, calculation and sorting functions.

Index calculation. Tracking general and sectoral market movements is important in the securities industry itself and beyond it into futures and options markets where large investors hedge securities positions. Timely and accurate calculation of indexes is therefore very important. This is mostly easily achieved by computer and is usually done by the market provider based on the stream of data on trades.

Market monitoring. There are sometimes rules designed to reduce volatility which slow the process down when the price of a security moves sharply up or down or there is a large general market movement. These are called circuit breakers or market halts. In order to detect such movements and institute the trading break, the flow of trades must be monitored. This is most easily achieved through computerization, but in a trading floor environment, such monitoring can be done manually by stock exchange personnel observing the flow of trades on the floor and taking the necessary action.

Market surveillance. In order to detect breaches of trading rules, market manipulation or insider trading, most markets institute a surveillance program. Again, computerization is the usual method but some surveillance can be handled manually. Common surveillance techniques are: identifying historically unusual price and volume or concentrated buying patterns in a stock or group of stocks and correlating these with announcements or rumors concerning listed companies or with the close-out of futures and options contracts based on securities. Surveillance identifies trades which raise a question mark about possible breach of the law which are assessed and, if warranted, passed on for detailed investigation. Surveillance is commonly conducted by market providers but also directly by supervisory authorities.

Investigation support. Both market providers and supervisory authorities are involved in the investigation of possible breaches - the market provider in relation to the rules of the market and the supervisory authority in relation to the law. In pursuing investigations one of the most important aids is an "audit trail" or detailed sequence or records related to the activity being investigated. And because much investigatory technique resolves to identifying relationships between two or more events or persons, or between persons and events, a computer data base is an especially useful aide. This is particularly so because the data to be sifted is often voluminous.

PRINCIPAL FEATURES OF AUTOMATION IN THE KOREAN SECURITIES MARKET¹⁷

Trial processing of batch data by the Korea Institute of Science and Technology in 1975 was the starting point for the Korea Stock Exchange computerization program. Securities clearing and basic market information services were offered. In September of 1977, the Korea Securities Computer Corporation (KOSCOM) was established by the Exchange as an electronic data processing center for the exclusive use of the securities industry.

Price Quotation and Trading Characteristics. The Stock Market Automated Trading System (SMATS) is a fully automated continuous auction quote driven market. It handles 94% of trading on the Korea Exchange.

SMATS receives and classifies orders by issue through system terminals installed in securities companies located across the country. SMATS then generates a table of orders per issue on the screen of the system monitor installed at the trading post. Trading contracts can be performed either automatically or semi-automatically. The transaction results are automatically transmitted by SMATS to member firms. SMATS also provides necessary data for market surveillance and supervision of member firms. An upgrade to system hardware has increased the capacity of the new system to handle more than 250,000 quotations daily. The improved system also made it possible to maximize efficiency of data processing and to handle large volume transactions, while the former system was able to handle only less active issues.

Each part of the serialized central processing unit is separately composed of a multi-processor; consequently, data can be processed through one processor in case of a malfunction of one of the other processor. Data snagged due to a malfunction of one processor will be rerouted automatically to an operational processor. Secondly, by adopting a dual access controller in the supplementary memory unit, when the controller is use stumbles, the other controller will be able to take over. Furthermore, dual recording of data on both disks was introduced to use a back-disk in case of a disk malfunction.

¹⁷ Korea achieved many of its securities market objectives by creating or remodeling institutions through strong, direct government intervention. This requires a high degree of political and financial strength. On this point see Yilmaz Akyuz, "Finance Policies in Developing Countries", p. 55.

Order-routing. Under the current Computerized Order-routing System by (CORS), which was put into operation in February 1983, customer orders are transmitted directly to the booths of member firms on the trading floor, or to the appropriate post terminals in cases where the issue is being executed under the SMATS. After a transaction has been completed, the results such as the price and the volume are transmitted back to the terminal of the company that placed the order. A new order routing system is being developed with the capability of operating within the dual access controller in the enhanced trading system described above.

Stock Price Display System. Electronic display boards installed on three of four walls of the floor of the Exchange are operated by the Stock Price Display System. On the boards, stock prices are displayed and can be read from any location on the floor of the Exchange. Displayed are the closing prices of the previous day, last sales price, best bid and asked prices, and price changes for all listed issues as well as the composite index, total trading volume, and number of advancing and declining stocks. The system also feeds this information on a real time basis to the display boards of the securities companies.

Clearance and Settlement. The Korea Securities Settlement Corporation (KSSC) settles all securities traded on the Exchange. It is a book entry system with rolling well settlement. All securities issued by listed companies must be deposited with KSSC and all the SMATS data output is fed direct to KSSC with in turn is linked to brokers by CORS. Settlement occurs on T + 2.

Market Information. There are two types of information service system. One is Stock Market Information Service (SMIS) system, and the other is the Securities Information Service (SIS) system. The former has been operation since August of 1980. The SMIS system collects the constantly changing stock price data such as bid and asked prices and transmits these data to the main computer via post terminals installed on the floor of the Exchange. After processing stock price data, the SMIS system displays the stock price on the Exchange display boards, and feeds the data to all securities companies located throughout the country. This system also stores various stock-related data in the computer to be used for such functions as publicity, transfer settlements, sales screening, and various other related activities.

The SIS was initiated in June of 1985, and while similar to the SMIS in some respects, it offers far more extensive range of information on stocks, bonds, company information, and other investment-related matters. The system provides a wealth of technical data used in analyzing and making

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investment decisions. The generation of colored graphics is one of the featured. Through the colored graphics, one can see daily, monthly, semi-annual and annual trends of all listed stocks, and the composite price index.

**PRINCIPAL FEATURES OF NASDAQ
AND LONDON STOCK EXCHANGE AUTOMATED OPERATIONS**

The NASDAQ System

The National Association of Securities Dealers (NASD), which is a self-regulatory organization of the securities industry responsible for the regulation of over-the-counter markets in the United States, was set up under the Maloney Act of 1938 amending the Securities Exchange Act of 1934. The NASDAQ System, the National Association of Securities Dealers Automated Quotations System, is a sophisticated computerized quotation display system for some 5,200 equities. The system started operation in February 1971.

Price quotation and trading characteristics. The NASDAQ market is a continuous auction quote driven market in which competing market makers quote continuous firm bid and ask prices for a specified standard order size. The quotations are made on a centralized electronic display system with each member of the system being able to call and compare quotations from all market makers that deal in a given equity. Trading takes place via telephone or fax except for orders that are passed through the Small Order Execution System (SOES) which is mandatory for small orders, or through the Advanced Computerized Order Execution System (ACES) which is for non-SOES orders and is optional.

Order routing and execution. The NASDAQ Small Order Execution System (SOES) was introduced in December 1984. SOES trades are automatically executed at the best price available in the NASDAQ System and reported to NASDAQ i.e. they are "locked in" and then transmitted to a clearing corporation. All telephone and teletype contacts between a customer's broker and a market maker are eliminated, and the paperwork formerly needed for clearing is replaced by computer transmission of the necessary data. The system has thus increased the efficiency of small-order handling, which is a mass business, in several respects: data processing time is reduced, manual labor cost is reduced, and sources of errors are reduced. Efficiency of order handling has been further improved by introducing a new computer interface which allows NASD Members to use automatic data processing for order routing and confirmation. The SOES system applies to order of 1,000 shares or less per deal.

Order matching, clearing and settlement functions. The NASDAQ System itself does not directly provide any clearing and settlement services. Instead, the System is linked with the National

Securities Clearing Corporation and the Depository Trust Company. The NASDAQ System assists its Members in the clearing and settlement process via its Trade Acceptance and Reconciliation System (TARS) and Automated Confirmation Transaction System which permits comparison of all trading details between two trading partners, resolution of un-compared trades passing through the clearing corporations and reconciliation of the trades in question.

Market surveillance. The system provides extensive market surveillance facilities based on a highly automated on-line system which permits the monitoring of every aspect of trading on the nationwide NASDAQ market. The system contains pre-set parameters for price and volume for every security. Any trading activity exceeding these limits is immediately signalled to the supervisors so that an investigation can be initiated. Computer-generated trading reports are available for daily, weekly and monthly analyses so that possible insider trading operations, market manipulation and other questionable trading can be identified at an early stage. Amongst the various programs that the NASD market surveillance staff uses for monitoring purposes are the following:

- The Price Watch and Volume Watch Systems monitor intra-day fluctuations in prices and volume and unusual real time volatility;
- The Blockwatch System provides real-time information on large-block trading in giving with details on the reporting firm, price, volume and time of trade;
- The Quote/Trade Comparison System monitors compliance with trade reporting rules;
- The Insider Exception System identifies price and volume changes before and after news releases by quoted companies in order to identify possible cases of insider trading;
- The Stockwatch Report signals unusual price and volume movements over weekly periods.

The NASDAQ Equity Audit Trail is a fully-integrated data base for second-by-second information on quotations, transactions and clearing for all NASDAQ securities and for every market maker. This system captures essential trade data, such as the following: security number, price, amount, time of trade, name of clearing organization, an indication whether the executing firm acted as principal or agent, and trade reference numbers of automated execution.

National and international market linkages. At a national level the NASDAQ System has been linked with the Intermarket Trading Systems to all other markets in the USA. The link is technically established via SIAC (Securities Industry Automation Corporation).

International linkages following data. 32,000 NASDAQ terminals out of a total of 200,000 are located outside the United States.

The most important link is the NASDAQ/London Stock Exchange Electronic Stock Link. Under this link 400 NASDAQ stock quotations are continuously displayed to brokers, dealers and institutional investors in the United Kingdom. The stocks include 200 of the largest NASDAQ stock by market value and 70 non-United Kingdom issues traded in the NASDAQ markets in the form of American Depository Receipts (ADRs). At the same time, securities firms using NASDAQ terminals in the United States receive current quotations in 400 London quoted stocks, on 100 stocks making up the FT-SE 100 Index and on 188 of the international stocks displayed on the SEAQ System, the London Stock Exchange Automated Quotation System. The NASDAQ System is also linked with the SESDAQ (Stock Exchange of Singapore Dealing and Automated Quotations) System with a daily exchange of quotations on 35 NASDAQ securities traded in both markets.

The London Stock Exchange

SEAQ, the Stock Exchange Automated Quotation System, of the London Stock Exchange which was put into operation on "Big Bang Day" (27th October 1986) was largely modelled on the NASDAQ System, although there are a number of differences. One of the main differences is that SEAQ covers all securities formerly quoted on the London Stock Exchange, while the NASDAQ System operates side-by-side with the traditional United States stock exchanges.

Price quotation and trading characteristics. Like the NASDAQ System, SEAQ is basically a screen-based quotation display and telecommunication system through which competing market makers continuously quote the ask bid and prices at which they are prepared to deal. Deals are executed via telephone except for small orders which are automatically executed via SAEF (the SEAQ Automated Execution Facility).

In contrast with the NASDAQ System, the SEAQ system consists of a number of different market segments with different rules and market practices. The equity market is divided into five sections:

Alpha, Beta, Gamma and Delta shares. Alpha shares are the most actively traded shares and market makers quote continuous ask bid and prices which are binding. Executed deals are immediately displayed on screen. Beta shares traded similarly except that market information on trading volume is released a day later. For Gamma shares, which are relatively inactive, market makers agree to quote two-way prices on an indicative basis without firm commitment to trade in specified volume. Finally, Delta shares are the least liquid equities. The SEAQ screens disseminate only the names of those firms which are prepared to deal in Delta shares. SEAQ International covers nineteen countries including North America, Australia, Netherlands, France, Germany, Hong Kong and Japan. 745 stocks are quoted, 350 of which are firm quotes.

Clearing and settlement. Trade confirmation is done automatically and clearance is by a book-entry system and payment can be effected electronically or by cheque.

Market surveillance. The market surveillance system is similar NASDAQ. On the basis of continuous trade reporting an "audit trail" is established which is stored in the surveillance system in order to allow investigations at a later stage. Movements in prices of individual securities are continuously monitored with a view to detecting at an early stage any irregularities including incidents of insider trading. Price behavior and transaction volumes are also monitored around the time of important company news releases. In addition, the market surveillance system is used for checking on whether market makers comply with accepted rules and market practices.

International linkages. For the market system link between SEAQ and NASDAQ see the section on NASDAQ above. In addition, the London Stock Exchange has established.

THE TORONTO STOCK EXCHANGE COMPUTER ASSISTED TRADING SYSTEM (CATS)¹⁸

Regular Trading. CATS enables a trader to enter buy and sell orders, monitor order status, receive printed confirmation of orders and fills, and access a broad spectrum of market information, trading data and statistics. The CATS screen is divided into four sections. The first three are six-line areas used for information display and order entry. The fourth segment is reserved for general, order fill, and market change messages. The keyboard contains a variety of specialized function keys to facilitate rapid order entry and data access.

The trader enters an order by keying the order details, checking the edit response for accuracy, entering the order to the system and verifying the order confirmation message. Depending on the market and the conditions specified during entry, the order could be: matched with another order in the central computer file and traded immediately, queued for a fill, or killed immediately. Alternatively, a combination of these results might occur, such as a partial fill with the remainder of the order volume queued or killed. All orders are treated in strict price and time of entry priority, thus ensuring a pure auction market where no order can be overlooked or "traded through".

Printed confirmation and status messages are immediately received by the trader for each of his orders. Messages are also sent to the terminal when an order is filled and when a market change moves a queued order on or off the bid or ask prices.

The CATS Trader controls the parameters of an order. Details such as how much of the total volume of the order is disclosed to other traders, the limit price, and the duration of the order are specified by pressing various data keys during the order entry procedure. However, once the trader has made his decision and the order is entered to the system, the central computer takes over. It notes the order details, searches for a match, fills, queues or kills the order, and sends the appropriate messages to the traders involved. If the order is not filled or killed immediately, the system queues the order for the duration specified by the trader (up to one year) until the market moves to the trader's limit price.

¹⁸ This Annex is derived from a Toronto Stock Exchange promotional booklet.

Market Opening. During the pre-opening period, the system accepts orders with limit prices and hold them for execution at the opening. Each time an order is entered, the computer reacts as though the market were opening immediately and calculates the price at which the most securities will trade. When equal volume will trade at each of two or more prices, the price leaving the least imbalance between buy and sell volumes will be chosen. If there are two or more prices at which an equal imbalance of volumes exist, the price nearest the closing price of the previous day is selected.

At the opening, the system distributes the available securities by completely filling orders with buy prices higher and sell prices lower than the opening. Orders with a limit price equal to the opening will share securities equally on a board lot basis, first to their disclosed volumes and then, if sufficient securities remain, to their undisclosed volumes. All traders whose orders received securities at the opening are sent messages to that effect.

Special Terms Market. The CATS system provides a separate market for each security to bid/offer and trade orders with special terms. The special terms that are handled are cash, delayed delivery, non-net and minimum fill. Minimum fill orders can specify an all-or-none requirement or a minimum quantity to trade.

Execution of trades is handled differently from that of the board lot and odd lot markets. An order is matched by entering its item number as shown in the display. However, orders that have the same conditions and were entered earlier must be traded first.

There is a connection to the board lot market for minimum fill orders, in that, board lot orders have priority over minimum fill orders at the same price. Orders with other term can be traded outside of the board lot quote with approval from the Surveillance Department. This approval is done automatically within the system.

Market Surveillance. Surveillance facilities are extremely flexible within the CATS system. Each security can have its own parameter, either a percentage or dollar price change, set by the Surveillance Department. If a security passes two or three times the parameter or exceeds a certain percentage, a warning message is sent to Surveillance. If it exceeds four times the parameter, the security is frozen, allowing Surveillance to contact the trader and either allow the trade or not.

Surveillance can also halt trading in a security at any time.

Trade Reporting. Trade reporting is an inherent part of the CATS system. When the price of a bid and offer matches, the trade is executed, both parties are advised and the trade is publicly disseminated. If your Exchange chooses to automate one segment of its market first, a trade reporting mechanism exists so that the Information System contains all trades whether the origination is from the floor or the automated system. This same mechanism can be used to report off-floor trades.

Information System. The CATS software includes an extensive Information System which can be run as a commercial enterprise.

The Information System is a database of market information built from data obtained from real-time computer-to-computer links to other systems, including the floor system. These links must conform to the technical standards of the Information System. Enquiries can be made against this database of real-time consolidated floor and trading system data. The Exchange can provide a feed of this real-time data to vendors and any other system required.

This Information System, if run on a separate computer which is updated in real-time by the trading system and the floor system, could provide real-time information to many terminals. The user interface is exactly the same as that of the CATS terminals.

Real-time information includes:

- best buying and selling prices with size;
- deals with broker identifiers;
- accumulated information pr instrument;
- other total market and accumulated data as defined;
- block trades with broker identifiers;
- index system by sector, instrument, or other grouping.

Dozens of reports are generated from the Information System. These can also be made available commercially. For example, the TSE sells data on magnetic tapes for daily, weekly and monthly periods.

Automatic Trade Reporting. The system includes the facility to report all orders and trades to each broker's office in hard copy. Trades that are reported to the system rather than executed through

it can also be included. The messages are stored on-line so that the output can be restarted in the case of a printer running out of paper or the ribbon being replaced.

Reorganization Facilities. Each evening after the market closes, the files are reorganized to eliminate expired orders, and prepared for the following day. New traders, brokers, securities etc. are added to the system at this time.

Back-up to magnetic tape is performed both before and after reorganization. All files are saved daily on magnetic tape and retained for 5 days. At the TSE, historical files required to meet Ontario Securities Commission regulations are maintained for 7 years.

Batch Reports. The following batch reports are generated for each member firm utilizing the system:

- Open Orders by Trader
- Open Orders by Broker
- Removed Orders by Trader
- Removed Orders by Broker

Open order reports can be separated into new orders entered each day with a weekly summary of outstanding orders.

In addition, there are approximately fifty (50) distinct batch reports that can be generated for administrative and audit requirements. These batch reports are requested by internal staff and by member firms. In fact, additional revenue is generated at the Toronto Stock Exchange through the sale of these reports to external customers.

Administration and Control Function. The CATS Control and Administration staff handle all user queries regarding system or terminal problems, trade cancellations and dissemination of information to CATS traders. To assist the staff in performing their function, the CATS system includes facilities for on-line troubleshooting and auditing with a complete on-line audit trail of all orders entered. Also provided are batch facilities to update the security list, update user sign-in codes, handle trader transfer and update member name files.

Security-Access Control. The user passwords provide data security so that only the user that entered the orders can access information about them. The user can also dynamically change the last two (2) characters of his password when signing out. Further security is provided in that only certain classes of users can have access to certain information.

Potential Modifications. The CATS system can accommodate trading in virtually any security, including stocks, bonds, options and futures as well.

CATS can also be easily modified to meet unique needs. Display formats, security symbols, prices, and volumes can be changed to suit any trading environment. The system is also flexible with respect to trading rules and procedures. The system can be translated from English; for example, the Madrid system was translated to Spanish, all Paris systems were translated to French and the Sao Paulo (BOVESPA) system translated to Portuguese.

Order Management System (OMS). CATS has the capability to link to an OMS system which services broker back-office needs and order routing. For example, in Toronto, the CATS system links to third-party OMS systems that feed orders to the CATS system and the TSE has developed an interface CATS-OMS link for the Madrid Stock Exchange.

APPROACHES TO CLEARANCE AND SETTLEMENT

Trade for Trade

Trade-for-trade is the most fundamental form of clearance and settlement. Following the execution of the trade, the buyer of the security ensures that cash or a cash equivalent is available for the seller. The seller holds the securities in good deliverable form for the buyer. The two counterparties then agree to use some mechanism that allows an exchange of securities and funds to take place.

Any subsequent transactions between the two parties on the same trade date would be handled exactly the same way, but they would be wholly independent of the previous trade. Since the identity of the counterparty is always maintained, each party can assess its exposure to various counterparties by monitoring each trade and its status.

This method may be appropriate in low-volume markets, or in high-volume markets that use a highly automated system. Without such a sophisticated system, however, problems may arise. If, for example, a broker buys and then sells a particular security for settlement on the same day, it is often difficult to complete both receipt and re-delivery on time under this method, especially if the transaction is only one in a chain of receipts and re-deliveries of the same security.

Without netting of some kind, a broker requires cash (or bank loans) to cover the total value of all of his trades due for settlement on a given day. The generation and presentation of sufficient collateral, either in the form of securities or certified cheques from counterparty brokers, can be a burden. Any form of netting system reduces the cash requirements, and therefore the need to assemble additional collateral. A trade-for-trade environment is essentially one huge chain of trades; settlement conditions have to be fulfilled at every link in the chain for it to hold. When one transaction collapses, others may be affected.

In a trade-for-trade environment, transactions are usually not guaranteed by any central organization. This circumstance must be addressed by any trade-for-trade system, probably by creating sufficient, collateralized credit facilities for active market participants so that chains of transactions can settle without time-consuming intermediate credit decisions.

Netting

The growth of transaction volume in many markets has prompted investigation into processing techniques where the number of settlement transactions could be sharply reduced if securities did not have to be processed one by one (trade-for-trade). Instead, they are batch-processed, with one net settlement figure per counterparty resulting at the end of the trading day. This is called bi-lateral netting. Even though bilateral netting is the most rudimentary form of netting, its establishment does provide an important benefit to a marketplace. It moves participants into a form of netting, thereby reducing the total number of settlement transactions.

Issues concerning bilateral netting approaches include:

- Many deliveries are still required, possibly causing a large number of fails.
- Each counterparty's positions should be marked-to market, thus necessitating more marks-to-market than in more sophisticated systems. (Mark-to-market refers to the repricing of a counterparty's open positions for purposes of risk containment.)
- When many positions remain outstanding - that is, they do not net to a smaller, more manageable number - the chances increase that a buyer whose shares have not been delivered as scheduled will have to compel the seller to produce the securities. In some markets, the broker who is owed the shares initiates a "buy-in" procedure, under which either the clearing corporation or the other counterparty is compelled to deliver within a short time period. The broker who failed to deliver is then liable for any difference between the original execution price and the present cost in the market of those same shares.

Daily Netting

Daily netting (also known as "balance order" or "multilateral" netting) is a progression toward a more effective clearance method. Its major operational feature is that a counterparty's trading in a particular issue for a single day is netted. The firm might have executed many transactions that day in a single security - both buys and sells - with any number of other brokers (counterparties), but at the end of the netting process it will be left with one single obligation or credit in that security, either to the clearing entity or to one or more counterparties. The firm might be long 1,000 shares of XYZ or might

owe 1,000 shares of the same security to another counterparty.

Although the technique does not totally maximize netting efficiencies, it does significantly reduce the number of deliveries required - and fails likely to occur - on a daily basis. In this manner, it can accommodate substantially higher trading volumes than either the trade-for-trade processing or bilateral netting approaches. The multilateral system, however, demands that risk be handled in a different way. Counterparties to the transactions may change for settlement purposes, and trade guarantees are now required. The entity in charge of the clearance system must assure that risk is appropriately collateralized and that collateral is available for any excess liability. Precisely how the risk is to be apportioned must be both easily understood by all participants and strictly enforced.

Despite the advantages of daily netting, some problems remain. There is no off-set with subsequent days' trades, and therefore, there are more failed trades to be marked-to-market. It is unlikely that such daily netting systems will provide any dividend protection; that is, a purchasing broker's ability to collect a dividend that is due on a trade which remains open.

Continuous Net Settlement (CNS)

In a continuous net settlement system, daily netting is employed, and all open transactions at the end of a day are then offset against the next day's trades. For a high-volume environment, a CNS system, which includes daily marking-to-market of all obligations to the current market price, is one of the most efficient clearing mechanisms and effectively removes the risk from individual trades awaiting settlement. one of the major tenets of CNS is that the clearing entity interposes itself between the counterparties, thus becoming the counterparty to each compared trade.

This assumption of counterparty risk by the clearing entity should occur as soon as possible after a trade has been compared. Ideally, by the end of the trading day, counterparties should "owe to" and be "due from" the clearing organization, not each other.

Although it might theoretically be best for all countries to operate a CNS system, for some this may not be feasible at the present time or even desirable for the long term. If CNS may be appropriate for a market, it is beneficial to contemplate its implementation from the outset.

CNS systems have been developed to address the need for complete automation and full netting

in securities processing. By maximizing the consolidation of transactions, CNS has reduced delivery obligations to their minimum. However, this requires automatic book entry in a highly centralized and controlled environment.

Centralization does much to curtail risk for members of a clearance system. When centralization is combined with trade guarantees, individual parties to a trade are protected; they receive assurance that, regardless of the default of a counterparty, their compared trade will settle.

The basic CNS process, designed to be completely automated and to minimize manual intervention by participants, may proceed in the following manner. On settlement day, all transactions in each security are combined with previously unsettled trades (open long and short positions) to create a rolling net position representing the number of shares (or bonds, units, etc.) to be settled by each participant. All trades in eligible securities net to one settlement position per participant, regardless of the number and size of the trades.

If the participant is short (owes the clearing corporation) a given number of shares in CNS, those shares are then removed from its depository account (and delivered versus payment to the clearing corporation, if it happens to be a separate entity). When the participant is long in CNS, shares are similarly allocated to its depository account. Because the movements of securities are done by book entry without certificates, worries about denominations are eliminated and partial settlements can easily be accommodated.

Under CNS, daily money settlement can be handled with efficiency. At the end of the day, the participant either receives from or delivers funds to the clearing corporation, based on the net monies credited for settled positions, plus adjustments due to repricing (marking-to-market) of his open positions.

The CNS approach has several advantages. Settlement delays are reduced because continuous recycling of open positions permits securities received on settlement date to be turned round for delivery on a same-day basis. Complete dividend protection is provided, with dividends automatically posted to the participant's account. Further protection is provided because closing positions can be easily updated with new prices (marked-to-market) daily. This reduces market volatility for all participants should any individual firm fail. This mark-to-market is applied to any unsettled net position on settlement date. A participant carrying unsettled positions must pay (or add collateral) for any increase in the value of those positions, or may receive funds for any reduction in value. A member's CNS obligations are debited or

credited against the value of its open positions.

Markets considering moving to a CNS environment must be aware of some of the obstacles that might hinder such a transition. The system cannot function at full potential without a centralized securities depository (CSD). Legal restrictions may have to be overcome to make it possible for risk to be transferred from a counterparty to the clearing corporation itself. Finally, the concept of netting must be embraced by marketplace participants and regulators.

Rolling Settlement

As a result of practice and custom in the many markets throughout the world, various settlement time frames and systems have been developed. A significant difference is that some major markets work with an "account day" settlement cycle, while others employ "rolling" settlement. In the former, all trades for a given period settle on (or after) a specific ("account") day. They may be netted (using CNS or another type of netting system) and thus reduced to the minimum number possible. This form of settlement schedule increases the time period between trade date and settlement and may add to volume problems when markets are active.

Rolling settlement requires that all trades are scheduled for settlement the same number of days after trade date, which allows trades to settle on all business days of the week. For example, in a T+5 rolling settlement environment, Monday's trades are settled on the following Monday, five business days hence; Tuesday's trades are settled on the following Tuesday, etc. The result is that at any one time the number of outstanding clearances is effectively limited.

Because it avoids trade processing congestion, the establishment of a rolling settlement environment offers individual markets an opportunity to improve operational efficiency and reduce risk. It also permits markets to adapt to a T+5 or T+3 and, eventually, an even shorter settlement time frame.

When clearance and settlement time frames are standardized internationally cross border trading can continue to grow - not merely in volume, but more safely and conveniently as well. With these factors in mind, rolling settlement is recommended as the settlement method for all markets.

Trade Guarantees

In some markets, trades settle without guarantees; in others, the guarantee is total. Complete trade guarantees, that is, guarantees that apply to both securities and associated funds, require financial strength and considerable forethought about how failures and shortfalls will be handled. The members of the comparison and netting systems, as a whole, assume the system's risk. Although there are several methods of supporting the guarantee, one is for the clearing entity to maintain clearing funds based on contributions from members. When an actual default occurs, the clearing corporation's first responsibility is to make good on the money settlements and trades of the defaulting party. This may involve buying securities in the market to achieve settlement. Financial losses from the default are first charged against that member's clearing fund contribution. If that money is insufficient, the default is then charged against the corporation's retained earnings or the general clearing fund. A pro-rata assessment on all the other members may occur in the latter case.

Beyond the financial resources made available by members, the clearing corporation must have a variety of additional sources of funds, such as member deposits, liquid collateral, committed bank lines plus the ability to draw more funds from members when necessary. The capacity to withstand financial shocks is obviously crucial to the system, but it will also encourage the participation and confidence of members. In a sense, the financial strength of the clearing entity can have the effect of limiting problems before they actually occur.

When making contributions to the clearing fund, members will be assessed amounts in accordance with the financial risk they bring to the system. Usually, this will be determined by analyzing the member's historic clearing volume.

The trade guarantee can go into effect as soon as the comparison (matching) process has been satisfactorily concluded. With locked-in trades, for instance, the guarantee could conceivably exist as soon as the trade is compared and enters the system. Other trades could be guaranteed as soon as they are matched, whereas problem trades would be guaranteed as soon as they are corrected.

A system of guarantees must also apply to trades that fail to settle on their designated settlement day for any reason, including default by a member of the system. To preserve the integrity of the marketplace, the clearing system must keep guarantees in place in such an event. This, in fact, may be the true test of the resourcefulness and effectiveness of the clearance system.

To do so effectively - with minimal financial consequences to the corporation and its members - will require a mark-to-market procedure, risk analysis, monitoring and collateralization. Marking-to-market can confine risk to just one day because the member who has failed to deliver may be making daily mark-to-market payments if the price of the security is fluctuating. By limiting the risk this way, the period in which trades remain unsettled can be extended. Without a mark-to-market procedure, however, the amount of time the trade could remain unsettled would have to be significantly restricted.

Book Entry

In some markets, trades cannot settle until the physical certificate representing a security changes hands. Simply arranging the movement of paper certificates from one counterparty to another can be a time-consuming and often frustrating task, as well as labor-intensive and costly.

Such paper-based transfer methods add a layer of potential difficulty to the clearance process. Not only must it be determined in such circumstances who owes what to whom, but the certificates to be delivered must be found and prepared for delivery at a precise moment in time. (When cash and securities are not exchanged simultaneously, the risk exists that one of the counterparties will suffer because of the timing of the exchange. If the deliveries of cash and securities are not simultaneous, the party delivering first is at risk should its counterparty default, or even delay, the transaction.)

Those establishing or modifying clearance systems should strive to eliminate paper flows to whatever extent local laws and practices will permit and seek to amend local laws and practices to this end, if necessary. An alternative to dematerialization is to immobilize the securities in a depository.

With immobilization or dematerialization, book entry clearance and settlement can take place. In a book entry system, no physical securities actually change hands. The transfer of securities from one counterparty to another is completed electronically. This is a considerable benefit for all participants. The creation of a book entry system makes it much easier, and more appealing, for international investors to participate in domestic markets.

Book entry also facilitates the establishment of an efficient deliver versus payment (DVP) system, which is strongly recommended. When securities are transferred from one depository account to another, cash moves simultaneously, or by the end of the day.

Book entry and netting can greatly reduce the risk of failure to deliver by simplifying accounting procedures, but no such system can eliminate settlement problems entirely. Securities lending facilities can help alleviate some of the fails after netting has taken place.

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